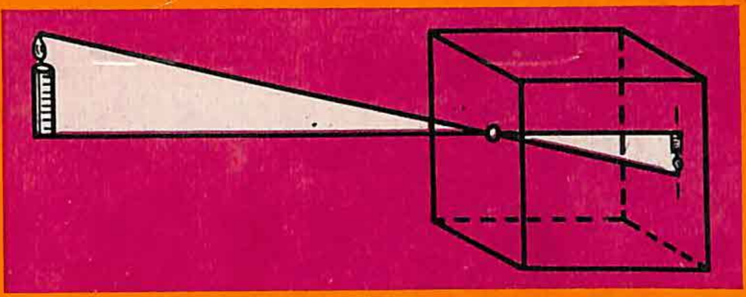
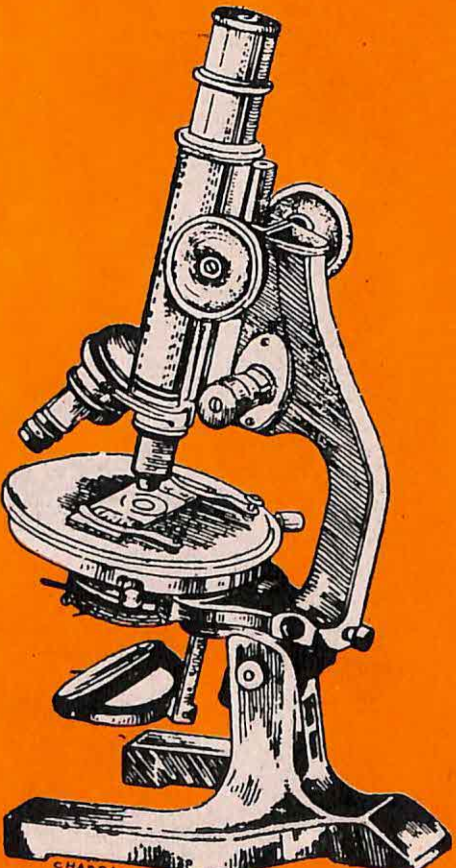
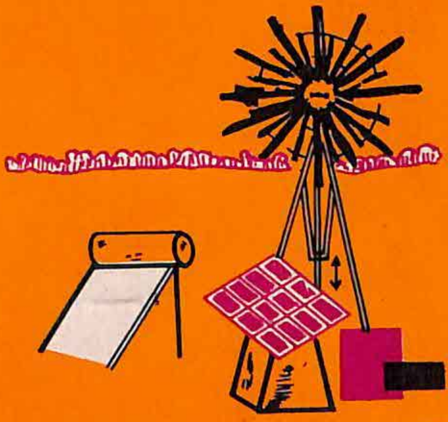
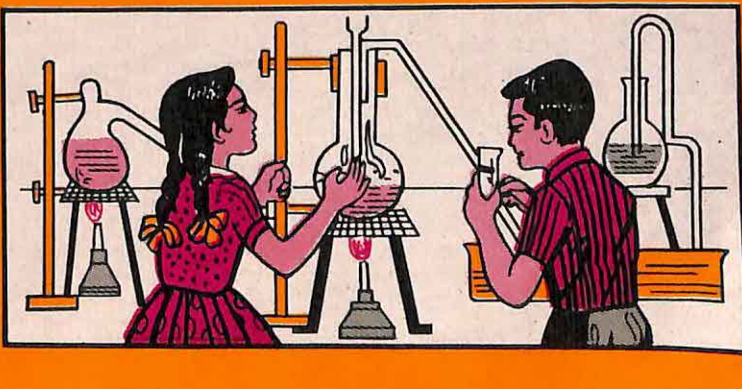
Modern Experimental SCIENCE

VOL. II









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Based on the latest syllabus in Science Practicals for Class X of the Secondary School Certificate Examination conducted by the Central Board of Secondary Education, New Delhi under the All India & Delhi Schemes.

MODERN EXPERIMENTAL SCIENCE

VOL. II

(FOR CLASS X)

By

2000

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PREFACE

This book has been written on the latest syllabus prescribed by the Central Board of Secondary Education, New Delhi for class X on practicals in science under the New Education Policy.

The emphasis in learning of science has been shifted to experimentation, observation and investigation rather than on memorisation of facts. The book presents a new approach to the study of science in everyday life through experiments.

The efforts of the authors have been to simplify each experiment to the level of the students and to explain it with the help of quality diagrams. The diagrams are clear, neat and accurately drawn. The style of the book and the quality of the contents is such that it will create in the students an interest in learning science practically by experiments. It would lead them to better understanding of the subject. They will gain the necessary self-confidence in the subject and acquire a natural curiosity to do more experiments of this kind.

There is always scope for improvement. Such improvements depend on the suggestions of students, parents and teachers of the particular subject. Their comments are most welcome.

We are thankful to the publishers M/s Pitambar Publishing Company for bringing out this book in the shortest possible time.

AUTHORS

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UNIT 1

ENERGY

EXPERIMENT 1.1

To prove experimentally that during the day there is a difference of temperature in the shade and the sun.

Apparatus : One table, 2 stands, 2 celsius thermometers. ($\frac{1}{2}$°C) and thread.

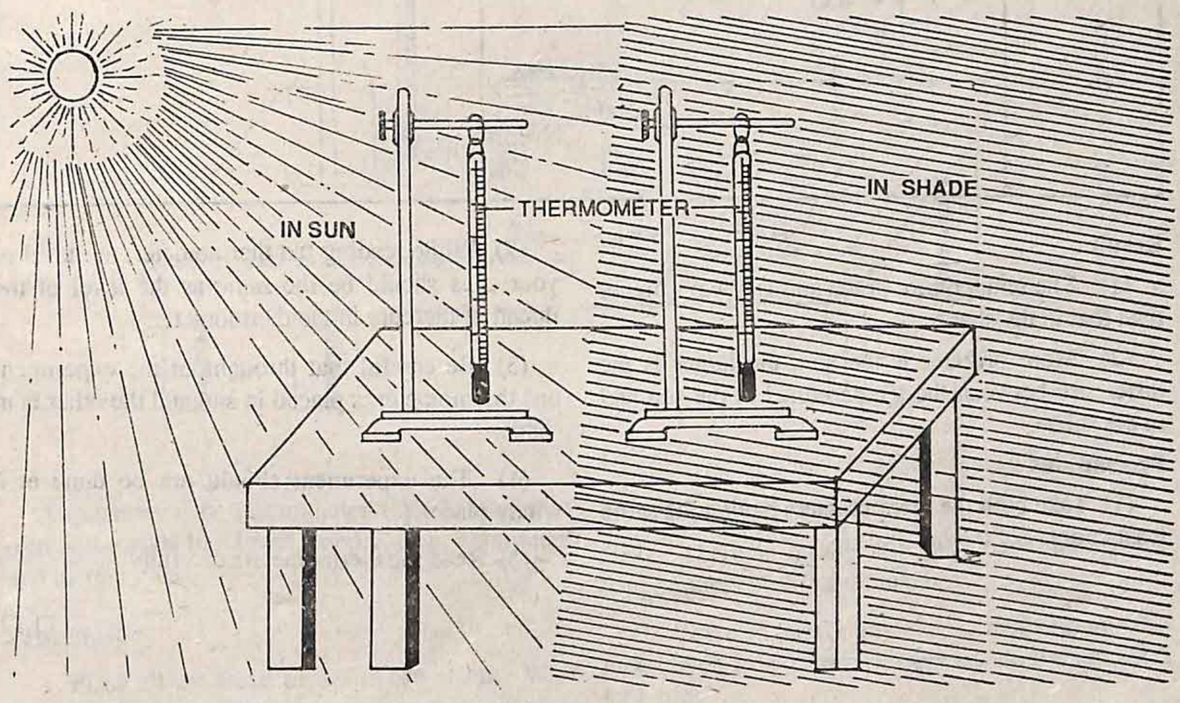

Fig. 1.1

Procedure :

(1) Arrange a table in the open such that half of the table is in sun and rest half is in shade.

(2) Suspend one thermometer on each stand keeping one stand in the sun and the other in shade such that you can read both the thermometers simultaneously.

(3) Take several readings of the two thermometers say at the intervals of 2 seconds.

(4) You will find that the reading of the thermometer in sun is always higher than that in shade.

(5) The difference in the readings of the two thermometers will be as much higher as brighter is the sun.

(6) Fill up your observations as follows :

Observations :

Least count of the thermometer = ...°C

Initial reading of the thermometer = ... °C

S. No.	*Reading of the thermometer in*	
	Sun *(in °C)*	*Shade* *(in °C)*
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

Result :

(1) The temperature in the sun is always higher than that in the shade.

(2) More brighter is the sun, the larger is the difference between the temperatures in the sun and in the shade.

Precautions :

(1) Take both the thermometers having the same least count.

(2) While reading the thermometer, the level of your eyes should be the same as the level of the thread of mercury in the thermometer.

(3) Be careful that throughtout the experiment one thermometer is placed in sun and the other is in shade.

(4) The experiment should not be done at a windy place.

(5) Read the thermometers carefully

□ □

EXPERIMENT 1.2

To measure and record temperatures of different metals placed in the sun and interpret the experimental data.

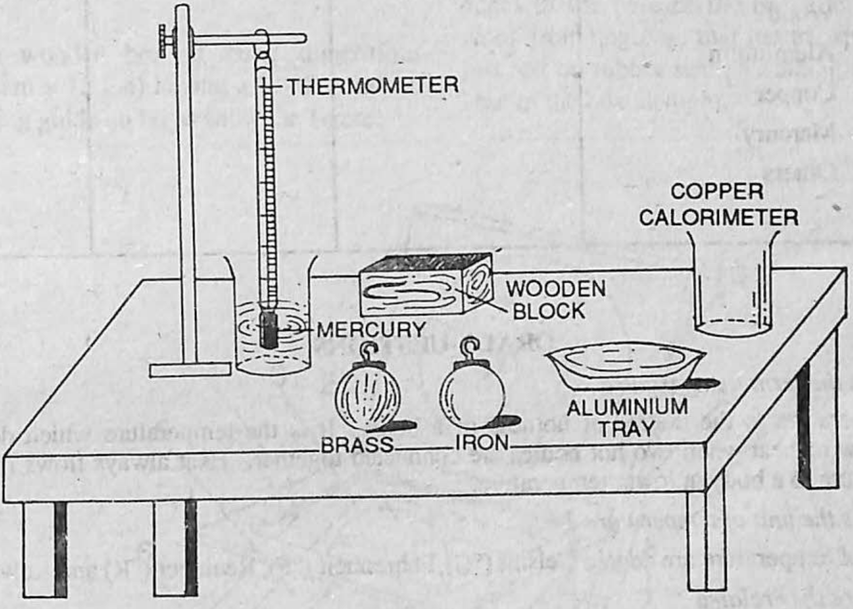

Fig. 1.2

Apparatus : A thermometer ($\frac{1}{2}$°C), pieces of different metals like brass, copper, iron, aluminium and mercury, etc.

Procedure :

1. Place all the metal pieces in bright sun. Wait for 10 minutes. Then note temperature of each metal piece from the thermometer. You will find a little difference among the temperature of metal pieces.

2. Allow the metal pieces to get heated by sun for next 20 minutes. Again note the temperature of each metal piece at the interval of 10 minutes. You will hardly find any increase in their temperatures.

3. Record your observations as follows :

Result :

1. There is hardly any difference among the temperatures of different metals.

2. There is hardly any rise in temperature of a metal even it is allowed to get heated by sun for a long time.

Precautions :

1. Take a celsius thermometer with least count $\frac{1}{2}$°C

2. Make a good contact of the bulb in thermometer with the metal piece before noting the temperature.

3. While noting the temperature, keep your eyes at the level of mercury thread in the thermometer.

4. Hold and read the thermometer carefully.

Observations :

Least count of the thermometer = ... °C

Intial temperature of the thermometer = ... °C

S. No.	*Name of the Metal*	*Temperature recorded after each interval of 10 minutes*		
		Set 1	*Set 2*	*Set 3*
1.	Brass			
2.	Iron			
3.	Wood			
4.	Aluminium			
5.	Copper			
6.	Mercury			
7.	Others			
8.	....			

ORAL QUESTIONS

Q. 1. *Define the term 'temperature .*

Ans. Temperature is the degree of hotness of a body. It is the temperature which determines the direction of flow of heat when two hot bodies are connected together. Heat always flows from a body at higher temperature to a body at lower temperature.

Q. 2. *What is the unit of temperature ?*

Ans. Units of temperature are degree Celsius (°C), Fahrenheit (°F), Reaumer (°R) and Kelvin (K).

Q. 3. *How are they related ?*

Ans. (a) $\frac{C}{100} = \frac{F - 32}{180} = \frac{R}{80}$ (b) Temp. in Kelvin = 273 + Temp. in °C

Q. 4. *What do you mean by 'heat' ?*

Ans. Heat is a form of energy. It is the energy of vibrational motion of the molecules of a substance. It becomes obvious when two bodies at different temperatures are connected together. Heat energy will flow from a body at higher temperature to that at lower temperature till the temperature of two bodies become same.

Q. 5. *What is the unit of heat ?*

Ans. It is measured either in joule or in calorie. 1 calorie = 4·18 Joules

Q. 6. *Why the temperature of the thermometer is higher in sun than that in shadow ?*

Ans. Because it received more heat per second in sun-light.

Q. 7. *Why the different metals placed in sun have almost the same temperature ?*

Ans. Until the sun is very hot and the metals are left for few hours in sun, whatever heat is aborbed by them per second the same is radiated back to the atmosphere. A part of it is also transmitted to inside of the solid. So all metals have almost the same temperature at a given time even after heating them by sun for a considerable time (40–50 minutes).

□ □

EXPERIMENT 1.3

To construct a model of a solar cooker using aluminium foil as a concave reflector (or any other suitable reflection surface) and demonstrate its use.

Apparatus : Wooden box with a handle, pot for cooking food, aluminium foil, transparent sheet of two glass plates fixed in a glazing frame, pieces of wooden cloth to be used as heat insulator and rubber sealing.

Procedure :

(1) Get a wooden box of outer dimensions (30 cm × 25 cm × 12 cm) having a handle, lid and mirror adjusting guide on lid as shown in figure.

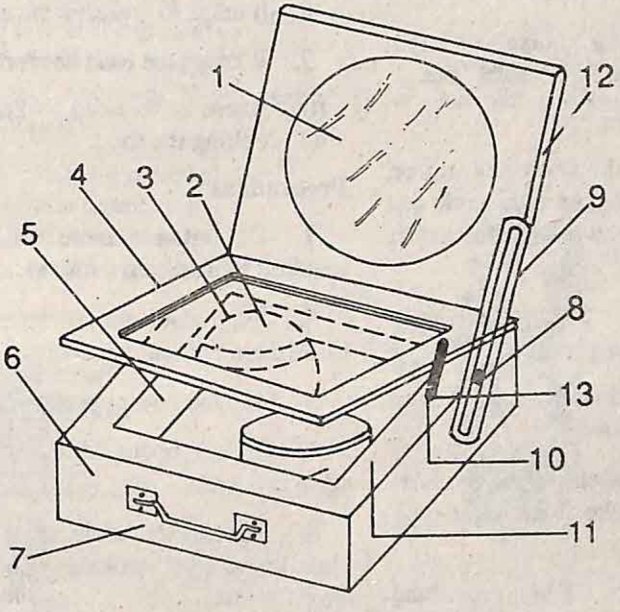

Fig. 1.3 Solar Cooker

1. Concave Aluminium foil (Mirror)
2. Pot for cooking
3. Transparent sheet of glass plates
4. Glazing frame
5. Pieces of woollen cloth (heat insulator)
6. Wooden box
7. Handle
8. Mirror support
9. Mirror adjustment and guide
10. Glazing stand
11. Rubber sealing
12. Lid

(2) Take a sheet of aluminium foil ($2\frac{1}{2}' \times 2\frac{1}{2}'$). Mould it in concave shape placing the sheet on a sphere of radius of about 2-3 ft. Now cut the extra foil with the help of a scissor to get a concave mirror (aluminium foil). Fix this mirror on the lid of box so that its concave side faces the base of the box by using fevicol or some other adhesive.

(3) Support the transparent sheet of two glass plates in a glazing frame with the help of hinges on the same edge of the box on which the lid is supported.

(4) Line up the rubber sealing on all the four top edges of the base of the box after removing little wood from edges so that the transparent sheet may just rest on rubber sealing making the inside of the base of the box air-tight.

(5) Put the lining of wooden clothes along all the four sides of the base of the box to make the base thermally insulated.

(6) Paint the pot black from outside for cooking.

(7) Put the pot at the centre of curvature of mirror (aluminium foil) in the base of the box.

Observations :

Least count of the thermometer = ... °C

Intial temperature of the thermometer = ... °C

S. No.	*Name of the Metal*	*Temperature recorded after each interval of 10 minutes*		
		Set 1	*Set 2*	*Set 3*
1.	Brass			
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□ □

EXPERIMENT 1.3

To construct a model of a solar cooker using aluminium foil as a concave reflector (or any other suitable reflection surface) and demonstrate its use.

Apparatus : Wooden box with a handle, pot for cooking food, aluminium foil, transparent sheet of two glass plates fixed in a glazing frame, pieces of wooden cloth to be used as heat insulator and rubber sealing.

Procedure :

(1) Get a wooden box of outer dimensions (30 cm × 25 cm × 12 cm) having a handle, lid and mirror adjusting guide on lid as shown in figure.

(2) Take a sheet of aluminium foil ($2\frac{1}{2}' \times 2\frac{1}{2}'$). Mould it in concave shape placing the sheet on a sphere of radius of about 2-3 ft. Now cut the extra foil with the help of a scissor to get a concave mirror (aluminium foil). Fix this mirror on the lid of box so that its concave side faces the base of the box by using fevicol or some other adhesive.

(3) Support the transparent sheet of two glass plates in a glazing frame with the help of hinges on the same edge of the box on which the lid is supported.

(4) Line up the rubber sealing on all the four top edges of the base of the box after removing little wood from edges so that the transparent sheet may just rest on rubber sealing making the inside of the base of the box air-tight.

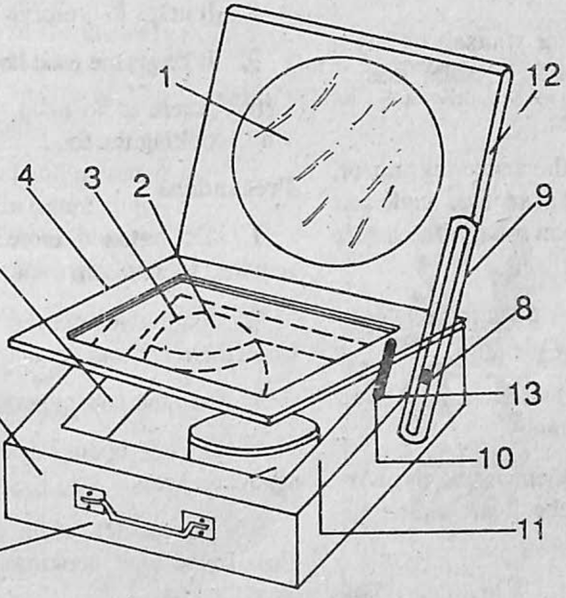

Fig. 1.3 Solar Cooker

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2. Pot for cooking
3. Transparent sheet of glass plates
4. Glazing frame
5. Pieces of woollen cloth (heat insulator)
6. Wooden box
7. Handle
8. Mirror support
9. Mirror adjustment and guide
10. Glazing stand
11. Rubber sealing
12. Lid

(5) Put the lining of wooden clothes along all the four sides of the base of the box to make the base thermally insulated.

(6) Paint the pot black from outside for cooking.

(7) Put the pot at the centre of curvature of mirror (aluminium foil) in the base of the box.

(8) Put some cooking material in the pot (say eggs for boiling). Add some water in the pot.

(9) Shut down the transparent sheet. Adjust the position of the lid and box so that maximum sun rays are falling on mirrors and after reflection they focus on the pot.

(10) The eggs will get boiled within half-an-hour.

(11) Instead of arranging a concave mirror of aluminium foil on lid, if you make plane mirror, the heat will reach uniformly throughout the base of the box and you can cook four materials in four different boxes.

(12) You can make your solar cooker yourself or you can buy it from local government selling agencies.

(13) Make a solar cooker for yourself or buy it and observe the process of cooking by solar heat.

How to Use the Solar Cooker :

1. Open the lid, position the reflecting mirror, with the help of mirror support at such an angle that the maximum sun rays reflection falls in the centre of tray.

2. Now open the transparent glass frame. Keep the frame stable with the help of glazing stand.

3. Put food inside the pot(s) after cleaning them and add sufficient quantity of water.

4. Close the pots and put them inside the box. Close the glazing frame. Make it air tight with knobs.

5. Open glazing frame after 1-2 hrs. depending upon the time taken for cooking the food. Be careful not to let steam escape out.

6. Take the pots outside with the help of a cloth. Open the pots and get cooked food.

Advantages of Solar Cooker :

1. It saves energy.
2. It saves money.
3. It is easy to use.
4. It is safe to use.
5. It does not produce any pollution.
6. It can cook four foods at a time.
7. It does not destroy nutrients.
8. It helps to preserve the environment.
9. It keeps the food hot for a long time.
10. There is no need to keep a constant watch while cooking the food.

Precautions :

1. Do not add more water than the amount required for cooking the food.

2. Vegetables should be cut in small pieces. Cook them without water.

3. Keep the pots closed while cooking.

4. Do not open the transparent glass frame again and again.

5. Be careful while opening the transparent glass frame after cooking. The steam will escape from the box.

□□

EXPERIMENT 1.4

To construct a model of a windmill and show its usage or develop a working model using unconventional sources of energy and show its usage in day-to-day life.

Apparatus : An iron stand, rings of 30 cm and 45 cm radius of thick metallic wire (0·2 cm in diameter), one central axle of cycle wheel on which the rim is supported, cycle needles, 24 blades each of 40 cm × 4 cm size made from iron sheet, an U-shaped rod.

Theory : Windmills are one of man's oldest and cheapest ways of producing power. A windmill has blades which turn as the wind blows through them. The turning force provides power for pumping water, electricity generation and for grinding stones. Since they are one of the cleanest and least expensive method of producing energy, they are widely used in different countries like Germany, Denmark and the Netherlands.

A Windmill is constructed of steel and mounted on a tower of metal girders as shown in figure. It has 12 blades each in 1 m × 0·15 m size equally spaced from each other and supported on two/one ring with their plane making an angle about 20° with the vertical. The height of the shaft on which the inner ring is supported is about 7 metres. The cut in wind speed is $2{\cdot}5\ \text{ms}^{-1}$ and the cut out is $10\ \text{ms}^{-1}$. The maximum discharge of air is 23000 litre/hour. A good windmill has efficiency of about 82%.

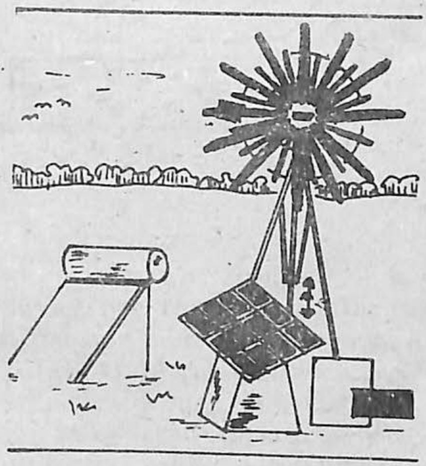

Fig. 1.4 (a) Windmill

You can find such windmills installed in various parts of Delhi and other places. These pump out water upto an height of 20 metres from the water level in earth for irrigation. You can seek the help of different local government bodies for installing a windmill in your school.

Procedure :

1. Get 24 blades welded with inner and outer rings such that the plane of blades make an angle of 20° with the outer ring and an angle of 5° with the inner ring.

2. Get a U-shaped iron rod welded with the central axle of cycle wheel at its centre.

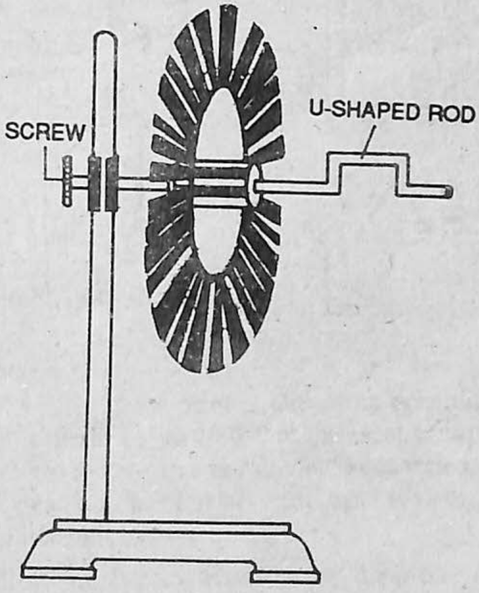

Fig. 1.4 (b) Windmill—detailed structure

3. Now weld the inner ring with the central axle of the cycle wheel with the help of needles.

4. Now weld this central axle on the horizontal upright of the iron stand so that it is free to rotate. Your windmill is ready.

5. Bring the windmill in open air and adjust its direction so that the air exerts maximum pressure on the blades and they start to revolve with the maximum speed.

6. The rotation of the windmills turns the U-shaped rod. The revolution of horizontal bar of the U-shaped rod about the central axle may make a piston to oscillate up and down by using a crank and shaft arrangement. The up and down motion of piston makes the water pump to work.

Conclusion : The model of windmill shows that the wind turns the windmill and revolve the blades and thereby produce rotational kinetic energy which can be used in many ways :

(1) To pump water from earth for irrigation as explained above.

(2) To generate electricity, couple the coil of the generator with the central axle. The coil will rotate in the field of the magnet in the generator and will produce electric power which charges a lead acid battery.

(3) The revolutions of windmill can make a grinding machine operate directly.

□□

EXPERIMENT 1.5

To develop energy from waste material and show how it can be used to do useful work and to identify and state the underlying scientific principle.

Material required : Waste material as dung of animals.

Theory : By using dung of animals in a biogas plant, we can obtain *biogas*. Biogas is a low cost source of fuel and energy. It contains 5·5 to 7·0% methane which is flammable.

The dung is mixed in equal amount of water in a tank as shown in figure. This concentrated solution reaches in the digestor by a pipe line. When there is no air in digestor, biogas is produced which is collected in a gas holder (metal cylinder) which floats over solution. It is called KVIC floating type biogas plant. The capacity of gas holder may be from 1 cubic metre (height 1 m to 1·5 m) to 10 cubic metre depending upon the availability of dung. In a plant of capacity of 1 m^3 gas, 25 kg dung is required every day. The gas in the cylinder can be retained for a period of 55 days. When you are using the plant first time, it may take 10 to 25 days to collect the gas in cylinder at such a pressure that it may be used.

Connect the outlet gas valve with a gas stove and gas lamp (mantle lamp). Open the stop-cock in the outlet valve, you can now use your gas stove or gas lamp.

Procedure :

1. Go to visit a Community/Domestic biogas plant in a nearby village.

2. You will find a tank as in Fig. 1.5 in which dung and water is mixed.

3. You will find a pipe going from the tank to digestor for supply of concentrated solution of dung and water.

4. Over the cylindrical digestor (about 1·2 m in diameter and 2m-3m in depth) you will find another cylindrical cover to collect the gas.

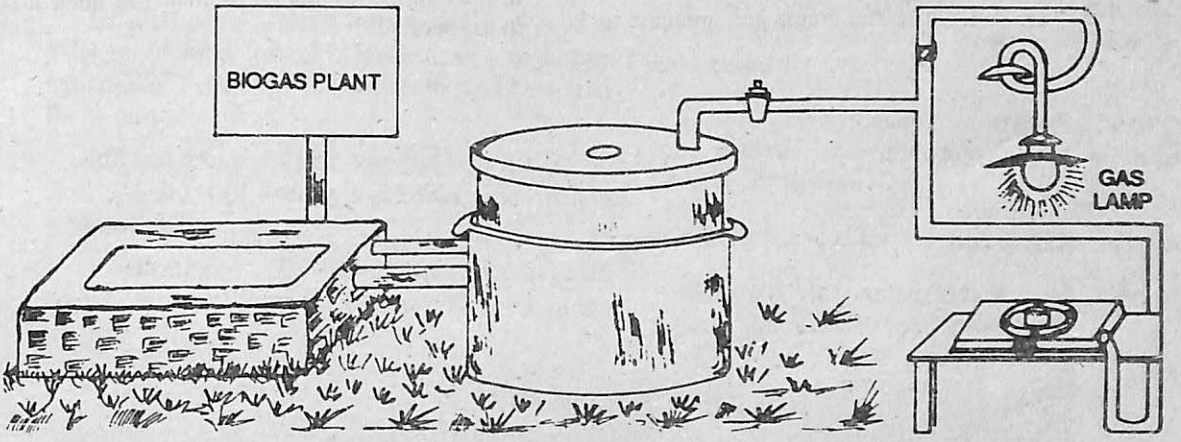

Fig. 1·5 Biogas Plant

5. If the plant is already in operation you can experience yourself that the plant is supplying the gas to gas stove and gas lamp connected with outlet valve in gas holder. You can see the stove and the lamp to work.

6. The used mixture of dung and water after getting lighted come at the top and are ejected through the outlet valve in the gas digestor which opens in a separate pit. This mixture after getting dried can be used as manure.

Conclusions :

1. In a biogas plant the dung of animals (cattles) is used as waste material. It supplies us

gas which can be used as a fuel for cooking and for lighting as energy. The methane gas is the result of a chemical process of dung in water.

2. Government of India has installed a power house of 3.75 Mw costing Rs. 18 crores using 300 metric tonne waste material as a fuel per day. The waste material is burnt in a special furnace. The heat so produced converts the water into steam which turns the turbine coupled with an electrical generator and thus electric power is generated.

Precautions :

1. Mix the dung and the water in the ratio of 1:1 in the tank.

2. Add the required quantity of dung everyday in the tank.

3. Do not allow the foam and manure to be deposited on the walls of the digestor.

4. Never burn the gas near the main gas outlet directly. There may be an explosion.

5. When you are not using the gas, close the stop cock of the main outlet.

6. The gas holder should not get rusted.

7. Close the regulator of gas stove and gas lamp properly after use.

8. Never allow anybody to go inside the tank full of mixture of dung and water.

9. Do not try to inhale the biogas, it is poisonous.

10. Rotate the gas holder once or twice everyday to prevent the formation of foams in dung mixture in digestor.

□□

UNIT 2

FOOD AND HEALTH

EXPERIMENT 2.1 (a)

To test the presence of sugar in a given specimen of food.

Required material : (i) Food material (ii) Test tube (iii) Spirit lamp (iv) Match box (v) Citric acid (vi) Fehling's solution (A and B) (vii) Benedict's solution.

Procedure :

(1st method) : Take a little quantity of aquous solution of food material. Banana, potato, unripe tamarind or lemon can be taken as the food material for sugar test.

Add two drops of Citric acid and heat it slightly. Pour 3-4 drops of Fehling's solution. Stir it and heat it slightly.

Observation : The solution turns orange in colour which confirms the presence of sugar in the food material.

(2nd method) : Take a little quantity of aquous solution of food material. Add few drops of Fehling's solution A and B and then heat it slightly.

Observation : The solution turns brick red in colour which confirms the presence of sugar in the food material.

(3rd method) : Take 5 to 10 drops of extract of food material in a test tube. Add few drops of Benedict's solution.

Observation : The solution turns red in colour.

Result : Red colour indicates the presence of sugar in the provided food material.

EXPERIMENT 2.1 (b)

To test the presence of starch in a given specimen of food.

Required material : (i) Food material (Maize powder/crushed potato), (ii) Test tube, (iii) Clean water (iv) Dilute Iodine solution.

Procedure : Prepare a concentrated solution of food material. Take a small quantity of food material in a test tube. Rice, bread, wheat powder or sorghum (gram) can be taken in place of maize or crushed potato for starch test. Add a few drops of dilute Iodine solution to it.

Observation : The solution turns dark blue which confirms the presence of starch in the provided specimen of food material.

EXPERIMENT 2.1 (c)

To test the presence of protein in the given specimen of food material.

Required material : (i) Food material (egg white) (ii) Clean water (iii) Test tube (iv) Conc. nitric acid (v) Millon's reagent (vi) Ammonium hydroxide. (vii) Sodium hydroxide (viii) Copper sulphate solution (ix) Spirit lamp (x) Match box.

Procedure (1st method) : Take a small quantity of aquous solution of food material (egg white). Pulses, wheat, maize, beans, ground nut, egg, fish, milk, cheese and lean meat are the best sources of protein. Therefore any of these can be selected for the protein test. Add a few drops of 1·0% HNO_3 solution just enough to cover the food material and heat it slightly. Then add 3-4 drops of Millon's reagent and heat it slightly again.

Observation : The solution turns saffron (orange) in colour which confirms the presence of protein in the food material.

Procedure (2nd method) : Take a little quantity of aquous food material. Add one ml. conc. nitric acid to it, heat it, then cool it. Now rinse off the acid with cold water and add a little quantity of ammonium hydroxide solution.

Observation : The solution turns yellow on heating in acid and then turns orange in colour with NaOH which confirms the presence of protein in the provided food material (egg white).

Procedure (3rd method) : Take a little quantity of aquous solution of food material in a test tube. Add 2 ml. sodium hydroxide to it. Then add 2-3 drops of copper sulphate solution.

Observation : The solution turns violet in colour which confirms the presence of protein in the provided food material.

Experiment 2.1 (d)

To test the presence of fat in the given specimen of food material.

Required material : (i) Food material (ii) White paper (iii) Test tube (iv) Sudan reagent III or IV.

Procedure (1st method) : Rub the food material on the white paper. Milk, butter, cheese, ghee, nuts, egg yolk, meat, all types of oil are the best sources of fat. So any of these can be taken for the fat test.

Observation : The paper becomes semi-transparent which indicates the presence of fat in the provided food material.

Procedure (2nd method) : Take a little quantity of aquous food solution. Add very little quantity of Sudan III or IV into it.

Observation : Pink drops are adhered at the base of the solution which shows the presence of fat in the provided food material.

ORAL QUESTIONS

Q. 1. *In which forms do you find carbohydrates in the food material ?*

Ans. Carbohydrates are generally found in two forms in the food material— (a) Starch (b) Sugar.

Q. 2. *In the starch test, you obtain a dark blue colour. What is the chemical name of this product ?*

Ans. The chemical name of the dark blue coloured substance is Starch Iodide.

Q. 3. *In which test do you use Benedict's solution ?*

Ans. Benedict's solution is used in sugar test.

Q. 4. *Which form of carbohydrate is soluble in water ?*

Ans. Sugar which is a form of carbohydrate, is soluble in water.

Q. 5. *What are the components of protein ?*

Ans. The main components of protein are carbon, hydrogen, oxygen, nitrogen and sulphur.

Q. 6. *Write the names of any six food materials which contain protein.*

Ans. Protein containing food materials are — pulses, maize, groundnut, egg, cheese, milk.

Q. 7. *Is fat soluble in water ?*

Ans. No, fat is not soluble in water.

Q. 8. *For which test do you use Sudan reagent ?*

Ans. Sudan reagent is used to identify the presence of fat in the provided food material.

□□

EXPERIMENT 2.2

Study of culture of baker's yeast and moulds occurring on stale bread, decaying fruit and other food items under the microscope.

Culture of Baker's yeast : The culture involves three main steps *i.e.*,(i) Preparation (ii) Inoculation (iii) Incubation.

Preparation of medium of culture : The right kind of culture medium should have nutrients and a proper pH atmospheric oxygen, osmotic pressure, etc. Prepare this type of culture. Dissolve 25 gms malt extract and 15 gms Agar-Agar in 1000 ml distilled water in a flask.

Inoculation : Take the medium in a petri dish. Pour a very little quantity of yeast powder. Now cover this petri dish with another petri dish.

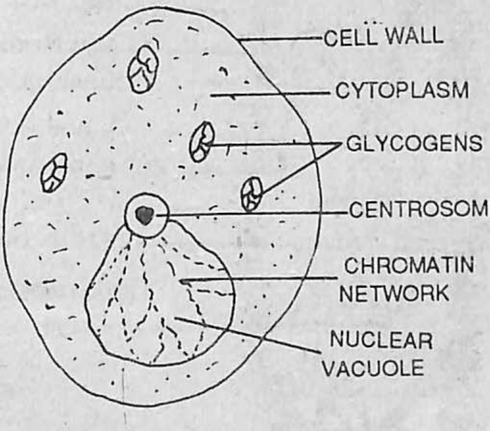

Fig. 2.2.1 A magnified cell of yeast

Incubation : After inoculation, the covered petri-dish is placed at a safe place at suitable temperature for proper and rapid growth for one or two days. About 30°C to 35°C temperature is suitable for the growth of the culture.

Now take out the culture for examination and testing purpose.

Culture of Mould (Rhizopus) : Rhizopus is a saprophytic fungus so it can be grown on dead organic matter like damp bread, butter, glycerine etc.,in a dark place. After 3 or 4 days you will get mould in larger quantity.

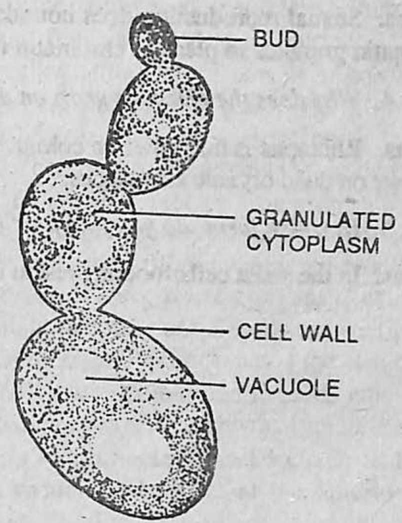

Fig. 2.2.2 Yeast—Reproduction by budding

Yeast Cell :

Division	Thallophyta
Subdivision	Fungi
Class	Ascomyces
Type	Yeast

Characters :

(i) Provided spot slide is of yeast cell.

(ii) It contains granulated cytoplasm and a vacuole.

(iii) One nucleus is present in the centre of the cell.

(iv) Some glycogen granules are present in the cytoplasm in the form of scattered groups.

(v) Chlorophyll is absent.

(vi) Cell wall is made up of fungus a cellulose.

ORAL QUESTIONS

Q. 1. *How do the yeast cells increase their number ?*

Ans. Yeast cells increase their number through asexual reproduction *i.e.,*budding.

Q. 2. *Why is it easy to culture the yeast and moulds ?*

Ans. Yeast and moulds multiply asexually which requires only a sufficient amount of food material and a suitable temperature.

Q. 3. *Do you find sexual reproduction in yeast ? If not, why ?*

Ans. Sexual reproduction does not take place in yeast because the nucleus of the yeast cell contains the chromatin granules in place of chromatin network..

Q. 4. *Why does the rhizopus grow on dead organic compounds ?*

Ans. Rhizopus is non green in colour. It lacks chlorophyll and can not prepare its own food. Therefore it grows on dead organic substances.

Q. 5. *In which form do you find food in the yeast cell ?*

Ans. In the yeast cells food is present in the form of glycogen drops.

□□

EXPERIMENT 2.3 (a)

To study micro-organisms (paramecium, amoeba) in pond/sewer water under the microscope.

Required Material : Pond water, plain slide, cover slip, dropper, compound microscope.

Procedure : There are numerous members of Phylum Protozoa but Amoeba and Paramecium are two main organisms which can be studied easily in the laboratory. Both can easily be obtained from stagnant water (pond, ditch etc.) and also from sewer water.

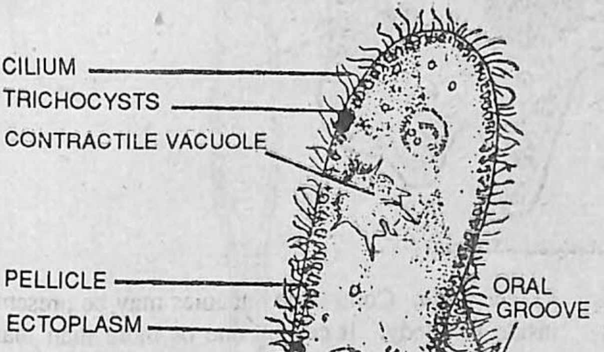

Fig. 2.3 (a) 1. Paramecium –Structure

Bring a test-tube full of pond water. Take a very small drop of pond water on the plain slide, cover it with cover-slip and examine it under microscope. You will find several amoebae and paramecia floating in the water. Their structures are as follows :

PARAMECIUM

Observation : Each paramecium is slipper shaped. Its one end is rounded and the other end is pointed. The whole outer surface is covered with a thin membrane known as *pellicle*. There are several small fibres situated at the surface. These fibres are called *cilia*. There is a deep groove on one side of the ventral surface. This groove is termed the *oral groove*. Its anterior part is called *trichocyst*. There is a bag like structure towards the inner side of the oral groove which is named as *gullet*. It makes connection of inner side with the outside. Cytoplasm is filled towards inner-side. It is of two types. One type of cytoplasm which is dilute and light in colour and lies towards periphery is called *ectoplasm*. The other type which is concentrated, dark in colour and towards inner side is called *endoplasm*. There are two nuclei (macro or mega and micro nuclei), food vacuole and two contractile vacuoles which lie at the anterior and posterior end. See Fig. 2.3 (a) 1.

Each contractile vacuole contains a vacuole in the centre which is called central vacuole. There are many other vacuoles facing towards all sides, known as *radiating vacuoles*. When all the essential elements are absorbed from the food and undigested part of food remains, this food vacuole opens outside at the fixed place which called *cytopyge*. It is at one side near the gullet.

AMOEBA

Put a small drop of pond water on the plain slide. Cover it with cover slip and examine it under microscope you will find in the following structures in the amoebic-body. Fig. 2.3 (a) 2.

(i) It is unicellular, colourless living being. The shape is not definite.

(ii) Its whole inner body is filled with a colourless concentrated liquid known as *cytoplasm*.

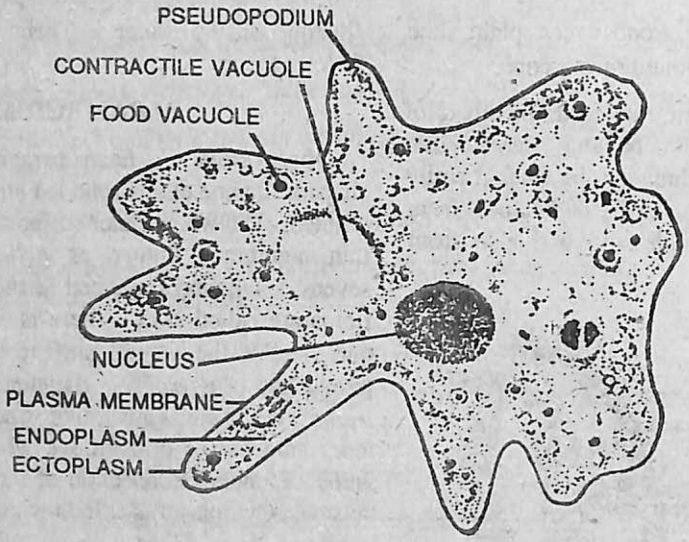

Fig. 2.3 (a) 2. Amoeba—Structure

A biconvex circular *nucleus* floats in the cytoplasm. Many projections produce from any side in the body which help in movement and capturing the food. These projections are called false feet or *Pseudopodia*. Contractile vacuoles may be present inside the body. It can be one or more than that according to the need and situation. Food vacuole is present.

EXPERIMENT 2.3 (b)

To study micro-organisms (Hydra) in a sample of pond water under the microscope.

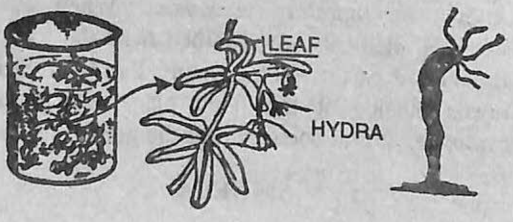

Fig. 2.3 (b) 1. Hydra in pond water.

Required Material : Pond water containing rotten leaves and twigs with hydra, watch glass, plain slide, cover slip, picric acid, water, glycerine, needle, forceps, brush, microscope.

Procedure : Hydra is found in the stagnant water attached to the floating rotten leaves or twigs. Take these leaves or twigs and examine carefully. You will find hydra in the form of white thread like tiny structures sticking with the lower surface of leaf and twig. Take out one Hydra with the help of the forceps from the decaying leaf. Put it on the plain slide on a drop of water. Examine its morphology and movement. Now put a drop of picric acid on this Hydra. The Hydra will become yellow in colour and inactive. Wash the Hydra with the help of pure water. Now put a drop of Glycerine on the dry and clean plain slide and then transfer the stained Hydra on the Glycerine drop. Cover it with cover slip and examine it under microscope. (See Fig.2.3 (b) 1 and 2.)

Observation :

(i) Hydra is about 2·0 to 2·5 millimetres long.

(ii) Its body is cylindrical and radially symmetrical.

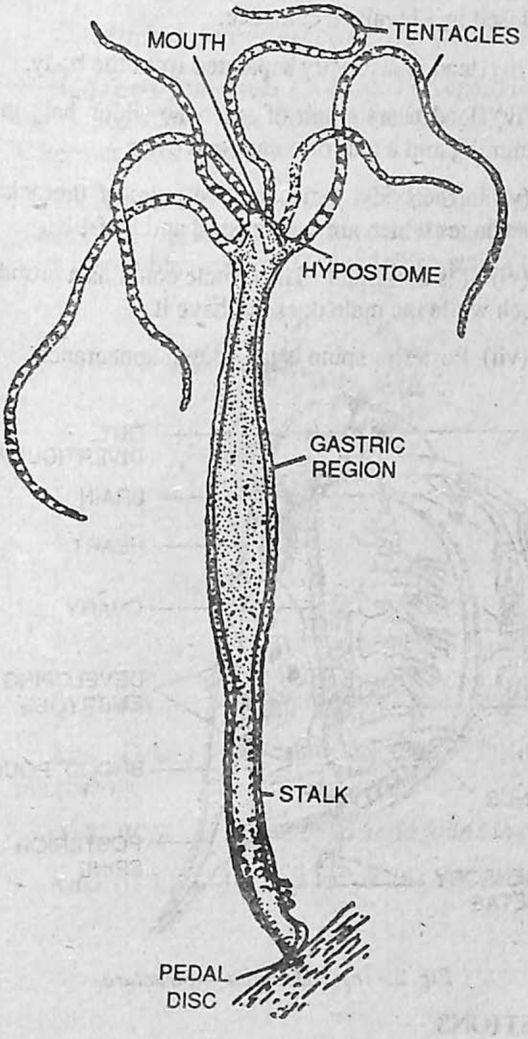

Fig. 2.3 (b) 2. External Features of Hydra.

(iii) It is diploblastic in nature, the outer layer is called ectoderm and the inner layer is called endoderm.

(iv) The whole body is attached to the substratum through the lower end or basal disc.

(v) At the terminal end there is an aperture known as mouth which is present in hypostome.

(vi) Hypostome is surrounded by 6 - 10 tentacles which are hollow tiny thread like sensitive structures.

(vii) Each tentacle contains many stinging cells which are known as nematocysts.

(viii) Most of the species of hydra are bisexual or hermaphrodite. Testes are situated at the terminal end while the ovaries are situated at the basal end.

EXERIMENT 2.3 (c)

To study the micro-organisms (Cyclops and Daphnia) in pond/sewer water under the microscope.

Required Material : Compound microscope, plain cavity slide, dropper, cover slip, pond or sewer water.

Procedure : Take a small drop of pond or sewer water in the cavity of the plain slide with the help of a dropper. Cover it with a cover slip. Examine it under microscope.

CYCLOPS

Observation :

(i) Body of cyclops is club-shaped having a broad portion anteriorly and a tapering portion posteriorly.

(ii) Body is divided into cephalothorax (head and first thoracic segment) and abdomen.

(iii) There is only one eye situated in the middle of the head region and two pairs of antennae situated anterior to the head.

(iv) There are five clearly visible thoracic and five abdominal segments.

(v) The 4th abdominal segment is bifurcated with a forked tail and the anus is situated dorsally.

(vi) It is unisexual. The female possesses a pair of egg sacs while the male is devoid of them.

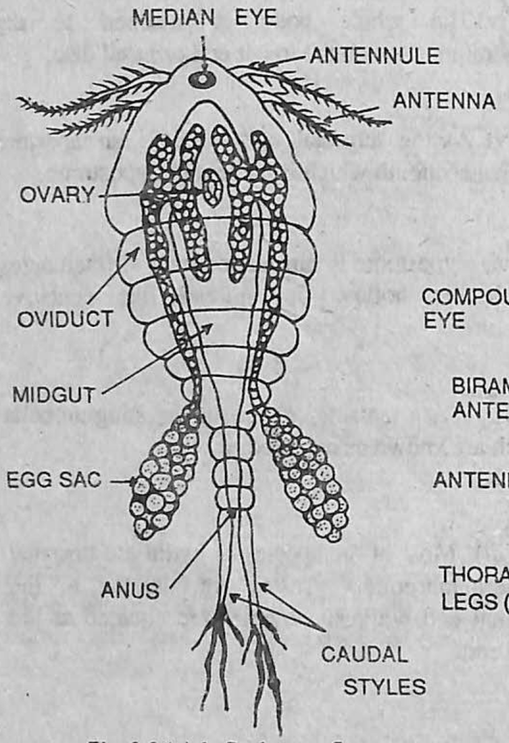

Fig. 2.3 (c) 1. Cyclops — Structure

DAPHNIA

(i) Daphnia is commonly known as water flea.

(ii) Its body is bilaterally compressed and is enclosed in a bivalved carapace.

(iii) Head is distinctly separated from the body.

(iv) Head bears a pair of antennae which help in swimming and a pair of compound eyes.

(v) In the body, there are five pairs of thoracic appendages which are compressed and leaf-like.

(vi) It is unisexual. The female contains a brood pouch while the male does not have it.

(vii) Posterior spine is tail-like in appearance.

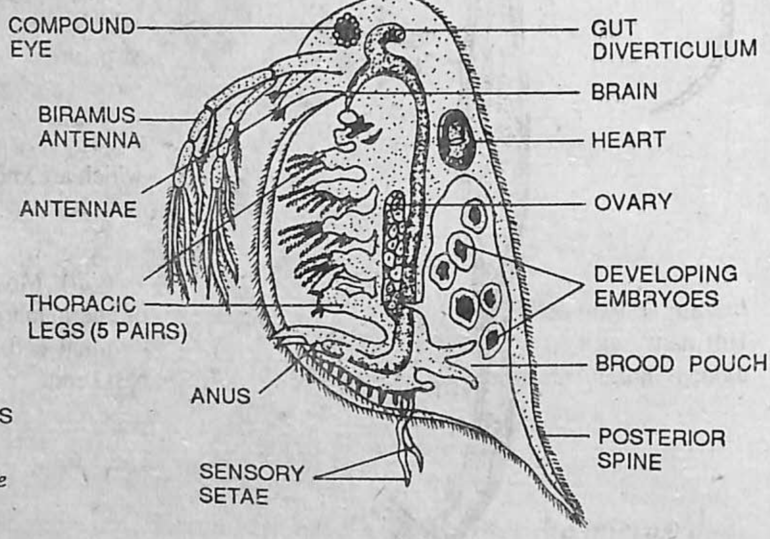

Fig. 2.3 (c) 2. Daphnia — Structure.

ORAL QUESTIONS

Q. 1. *Write the names of some one-celled animals found in fresh water.*

Ans. One-celled fresh water animals are, amoeba, paramecium, cyclops, daphnia, bacteria, verticella, euglena, etc.

Q. 2. *Write the names of some aquatic micro-organisms with their respective locomotory organs.*

Ans.

Micro-organism	Locomotory organ	Micro-organism	Locomotory organ
Amoeba	Pseudopodia	Euglena	Flagella
Paramecium	Cilia	Hydra	Tentacles

Q. 3. *Which micro-organism has two nuclei ?*

Ans. Paramecium has one micro nucleus and one macro nucleus.

Q. 4. *How many types of vacuoles are there in Amoeba ?*

Ans. There are two types of vacuoles in Amoeba :

(i) Food vacuoles and (ii) contractile vacuoles.

EXPERIMENT 2.4

To study bacteria from curd under the microscope by Grams staining.

Required materials : Curd, Forceps, Needle, Plain slide, Cover slip, Cotton blue stain, Glycerine, Compound microscope.

Procedure : Take curd in a small quantity on a plain slide. Spread it to form a thin film. Colour it with cotton blue stain or Grams Iodine stain (2 gms of Iodine + 3 c.c. Potassium Iodide + 300 ml of distilled water) and then put a drop of glycerine. Cover it with the help of a cover slip.

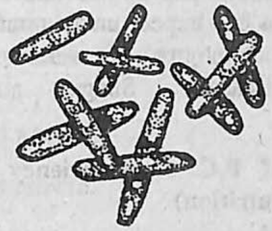

Fig. 2.4 Bacilli (bacteria)

Observation : On examining the prepared slide of curd bacteria you will note the following properties of bacteria.

(i) The bacteria are rod shaped and therefore termed as Bacilli.

(ii) Some bacteria are forming chain like structures are termed as Lacto-bacilli.

(iii) The bacteria do not have cilia.

Note : There are certain types of bacteria found in curd which are *i.e.,* Lacto-bacillus lectus, Lacto-bacillus bulgaris and Lacto-bacillus helveticus.

ORAL QUESTIONS

Q. 1. *What is the advantage of using the grams iodine stain ?*

Ans. Grams iodine stain colours the nucleus dark pink which can be then distinctly seen under the microscope.

Q. 2. *Write the names of bacteria found in curd.*

Ans. (i) Lacto-bacillus lectus (ii) Lacto-bacillus bulgaris and (iii) Lacto-bacillus helveticus.

□ □

EXPERIMENT 2.5

To identify various deficiency diseases of human beings using charts, models, figures and to comment upon them.

Required Material : Practical file, pen.

Sources : Survey and observation of local people suffering from malnutrition.

Theory : Malnutrition means a faulty diet. A normal diet of a person is that which completes all the vital requirements of food elements of the body. When the food does not fulfil the demand of the required food elements of the body, it is termed as malnutrition.

A poor diet lacking important requirements acts as the invitation to several diseases. Though our country is developing and prospering economically, still a large section of the population all over India is suffering from malnutrition. Under-nutrition results in several diseases including poor physical health, feeble mental development, loss of immunity, loss of appetite, poor digestion, eyes defects, etc. Under nutrition may cause the susceptibility to infections to other diseases.

For a normal growth and physical development, the person requires adequate amount of carbohydrates, fats, proteins, vitamins and various mineral salts. Each of the food element plays an important and independent role in the body. So the deficiency of each food element appears in the form of particular diseases. Some of the important diseases along with their symptoms and remedial measures are discussed here.

Procedure : Visit various persons inhabiting your area or a particular area or a place such as an orphanage or destitutes homes like Nari Niketan etc., where you can expect under nourishment and record the symptoms of various nutritional deficiency diseases. Suggest any remedial measures also.

Symptoms of P.C.M. (Deficiency of Protein Calorie Malnutrition).

1. Stunted growth.
2. Loss of appetite.
3. Underweight.
4. Skin is rough and dry.
5. Hair on head change their colour from black to golden at the terminal ends.
6. Hair loose their natural lustre.
7. Skin gets detached from the muscles in many parts of the body specially the fore and hind limbs, cheeks etc.

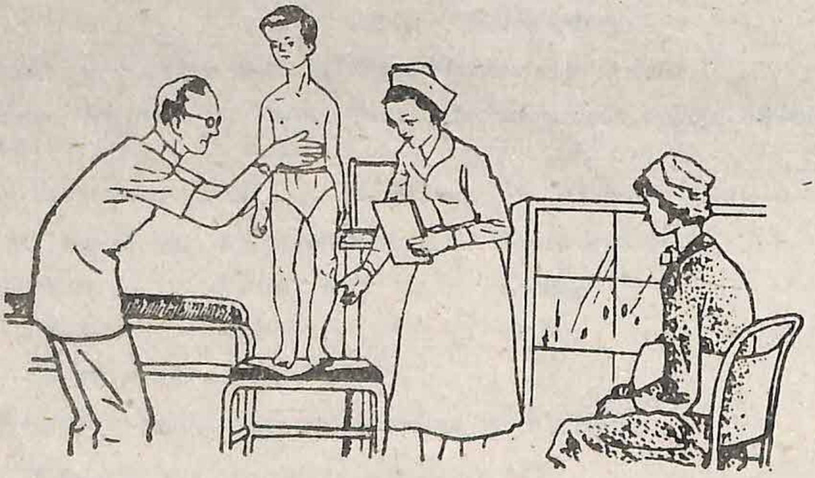

Fig. 2.5.1 A case of malnutrition

8. Abdominal belly is protruded.

9. Swelling on feet starts.

10. Person feels tiredness quickly.

11. Body muscles are poorly developed.

12. Eyes look sunken.

13. Face becomes thinner with sunken cheeks.

14. Body is more susceptible to infections. All the above mentioned symptoms are due to the deficiency of protein in the body. Common protein deficiency diseases are Marasmus and Kwashiorkor.

Symptoms of Marasmus :

1. Stunted growth.

2. Sunken eyes.

3. Body muscles develop feebly.

4. Abdominal belly protrudes out.

5. Absence of fat deposition in various parts of the body.

6. Thin face with sunken cheeks.

7. Skin becomes loose and detaches from the muscles in many parts of the body. It becomes folded at various body parts.

8. Body becomes more susceptible to infections.

9. Skin is rough and dry.

10. Terminal ends of hair become golden and rough like hemp.

Remedial Measures

1. The patient should take pulses in adequate amount regularly.

2. All protein containing food material such as milk, egg and fish should be taken.

3. Curd should be taken regularly. It should be the main part of food.

The National Institute of Nutrition, Hyderabad has suggested the following diet for a marasmus patient :

(*a*) Wheat corn (roasted) 40 g.

(*b*) Bengal gram 16 g.

(*c*) Groundnut 10 g.

(*d*) Jaggery 20 g.

Total 86 g per day which evolves 330 k. cals. energy.

Symptoms of Kwashiorkor

(i) Stunted growth.

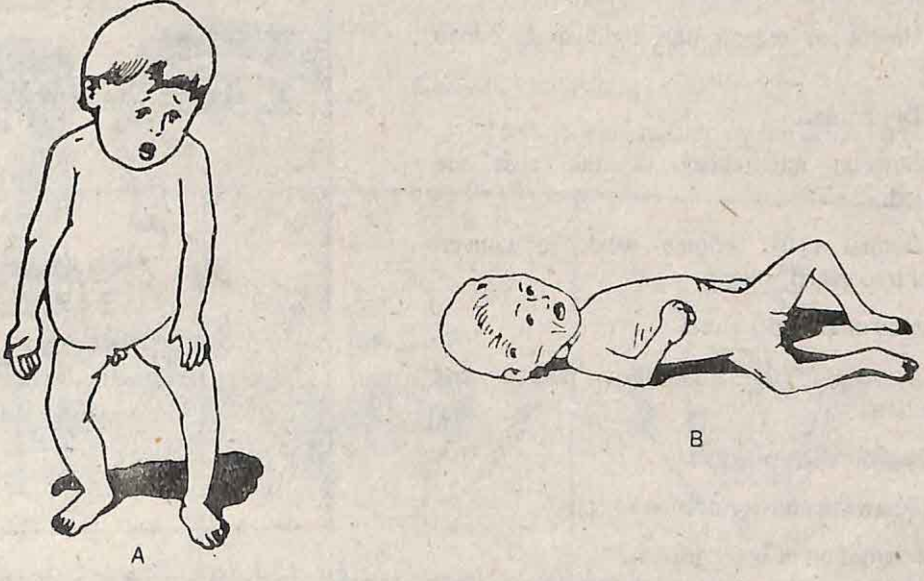

Fig. 2.5.2 Infant suffering from A. Kwashiorkor and B. Marasmus

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(ii) Loss of appetite.

(iv) Terminal ends of hair become golden and similar to hemp.

(v) Body muscles are properly developed.

(vi) Body becomes quickly tired.

(vii) Forelimbs and hindlimbs are less developed.

(viii) Colour of skin changes.

(ix) Protruded eyes.

(x) Swelling on feet in acute condition.

(xi) Skin becomes rough.

Remedial Measures : The patient should be more careful about his diet. His food should consist more of proteins. Other measures similar to that in case of marasmus diseases should be taken for kwashiorkor also..

Deficiency of Vitamins.

Vitamin A (B-ioniole). Its deficiency causes :

1. Night blindness.
2. Xeropthalmia

Symptoms of Night Blindness

1. Unable to see in dim light or defective vision.
2. Dry cornea.
3. Mucous membranes of the eyes are weakened.
4. Retinal cells become weak to convert sunlight into visual yellow.

Symptoms of Xeropthalmia

1. Dryness and inflammed cornea and conjunctiva.
2. Degeneration of cornea.
3. Ulceration and perforation of cornea.
4. Retardation of body growth.
5. Dryness of skin, lacrymal glands, meibomian glands, salivary glands, vagina etc.
6. Impotency in male and sterility in female.

Remedial Measures (Treatment)

1. Food rich in Vitamin A *e.g.*, green leafy vegetables, tomato, yellow fruits, carrots etc.,should be taken plentiful.
2. Non-vegetarians can take fish, yellow part of egg.
3. Vitamin A is also available in ghee, butter etc.

Pellagra. This disease is caused due to lack of Vitamin B_1 (Niacin).

Symptoms :

1. Skin cracks rapidly even during slight change of weather.
2. Skin becomes thick with red pigments on it.
3. Dermatitis takes place.
4. Patient suffers from diarrhoea.

Remedial Measures

1. The person should take maize or jowar in a

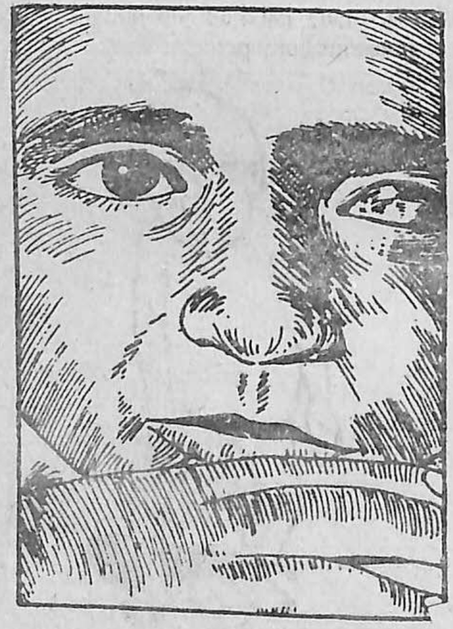


Fig. 2.5.3 Severe damage to the eye resulting in blindness due to deficiency of Vitamin A.

large quantity to overcome the shortage of Vitamin B_1 in the body.

2. The person should take germinating seeds, unmilled cereals, beans, fresh orange juice, tomatoes and eggs.

3. The person should take sunbath early in the morning in the rising sun.

Cheilosis. This disease is caused by the deficiency of Vitamin B_2 (Riboflavin).

Symptoms :

1. Skin starts cracking.

2. Inflammation of skin at the corners of mouth takes place.

3. General growth stops.

4. Inflammation of tongue is seen.

5. Reddening and fissuring at the angles of mouth takes place along with the inflammation of the lips.

Remedial Measures : The patient should be advised to take kidney and liver meat, eggs, milk, wheat, gram, pulses, spinach, lettuce, onion and yeast.

Scurvy. It is caused by the deficiency of Vitamin C. Its main symptoms are as follows :

1. Swelling of gums.

2. Haemorrhage takes place in the nose, gums, eyes etc.

3. General body weakness is felt.

4. Inflammation of tongue.

5. The bones become weak lacking in tensile strength.

Remedial Measures :

1. The person should take a large amount of fresh fruits and vegetables. He should take oranges, lemon, tomatoes, raw grapes, cereals and milk.

2. Sufficient breast feeding at the infant stages goes a long way in preventing the disease.

Rickets or Rachitis. This disease is caused due to the deficiency of Vitamin D (Antirachitic vitamin)

Symptoms :

1. Slow development of bones.

2. Deformity of bones starts.

3. Knees become joined together.

4. Legs get curved like a bow.

5. Sides of the chest get flattened. Generally children and infants suffer from this disease.

Osteo malacia. This disease occurs in adolescent female. Main symptoms of the disease are :

1. Softness of pelvic girdle.

2. Deformities of jaw bones.

3. Appearance of carious teeth.

Remedial Measures :

1. Vitamin D is prepared by the skin in presence

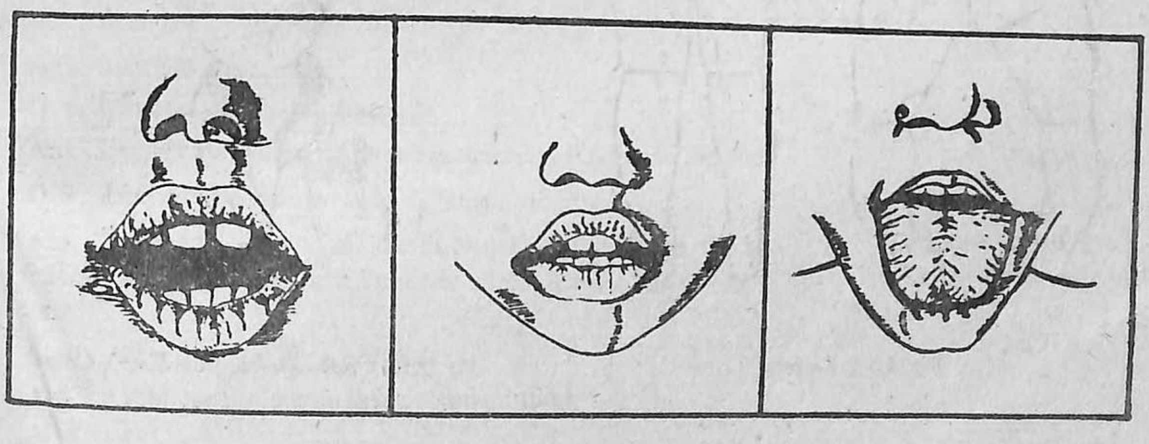


Fig. 2.5.4 Diseases due to deficiency of Vitamin B

of sunlight, therefore patient should be adequately exposed to sunlight. If possible sunbaths should be taken.

2. New-born child should be fed on mother's milk.

3. The person should take sunbath, if possible in the rising sun.

Anaemia : It is caused due to the deficiency of Iron in the form of Folic acid in the body. Its main symptoms are —

Symptoms :

1. Body becomes weak and
2. Person feels fatigued easily.
3. A loss of appetite occurs.
4. Haemoglobin amount is reduced in the blood.

Remedial Measures :

1. The patient should be advised to take in plenty of green leafy vegetables, eggs, liver and pulses.

Endemic goitre : This disease is caused by the deficiency of Iodine in the diet.

Symptoms :

1. Thyroid gland swells up and the gland buldges out in the neck, resulting in a condition known as the simple goitre.
2. Growth is retarded.
3. Mental development also becomes feeble.
4. Eyes protrude out.
5. Formation and development of bones and teeth is retarded.
6. Muscular control becomes poor.
7. Abnormality in the shape and structure of bones appears in any part of the body.

Remedial Measures :

1. The person should take fresh fruits, specially apple, grapes, apricot, peach.
2. Leafy vegetables are also helpful in this disease.
3. Ostocalcium tablets should be given to the patient.

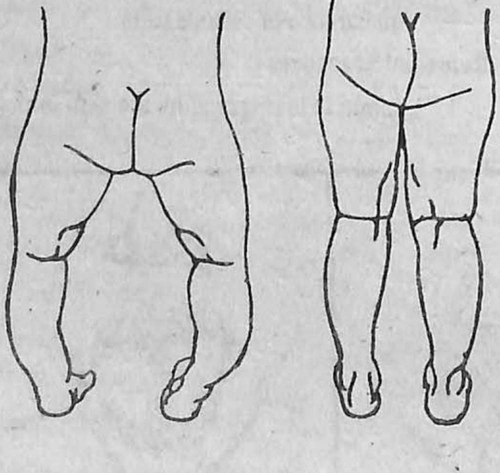


Fig. 2.5.5 Rickets

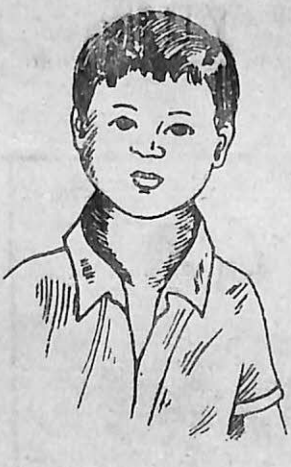


Fig. 2.5.6 A boy suffering from Simple Goitre

Observations : Students should observe people suffering from these diseases in their respective areas and record all the informations in the table given below :

S. No.	*Name of the person*	*Age*	*Sex*	*Abnormal symptoms of the body*	*Cause of symptoms*	*Remedial measures*	*Special remarks*

ORAL QUESTIONS

Q. 1. *What do you understand by the word 'disease' ?*

Ans. Disease is the abnormal condition of the body when some of the organs of the body do not function properly due to harmful effects of foreign organisms or injurious substances.

Q. 2. *What do you mean by an acquired disease ?*

Ans. A disease which is acquired by the person after birth is known as an acquired disease.

Q. 3. *What is the other term for Vitamin B_2 ?*

Ans. The other term for Vitamin B_2 is Riboflavin.

Q. 4. *What is the name of disease in which inflammation, the degeneration, the ulceration and perforation of cornea take place ?*

Ans. Xeropthalmia.

Q. 5. *What is the other term for Vitamin B_1 ?*

Ans. Niacin is another term for Vitamin B_1.

Q. 6. *What is the common name of antirachitic vitamin ?*

Ans. Vitamin D.

Q. 7. *What is the name of the disease caused due to the deficiency of Folic Acid ?*

Ans. Anaemia.

Q. 8. *Why is simple goitre caused ?*

Ans. Simple goitre is caused by the deficiency of Iodine in the body.

Q. 9. *What do you understand by deficiency disease ?*

Ans. The body requires all the essential food nutrients for the proper development. If there is deficiency of any food nutrient the body shows some abnormality of some kind known as a deficiency disease.

Q. 10. *What is the full form of P.E.M. ?*

Ans. P.E.M. means Protein Energy Malnutrition.

□□

EXPERIMENT 2.6

To identify and comment on various types of pests of stored food grains i.e., insect parasites in rice, wheat and pulses.

Material required : Actual specimens or charts or models of rice weevil, beetle (pulse beetle, red grain beetle), grain moth and rat.

The grains are stored after threshing with every type of precaution, even then some pests infest and damage it. Most of these pests are arthropods. They are somehow able to get into the godowns and feed on the stored food-grains. They complete their life cycle there. There are several types of pests which are of various shapes, size, colour and occur at different seasons. These pests can easily be recognised due to their specific features and habits. Some of the important pests of stored food grains are :

WEEVIL

(i) Weevil is an arthropod, commonly known in Hindi as *ghun*.

(ii) It is dark red or brownish red in colour.

(iii) The whole body is divisible into three parts, head, thorax and abdomen.

(iv) Head is very small bearing piercing type of mouth parts.

(v) Thorax is bigger than head and is without wings.

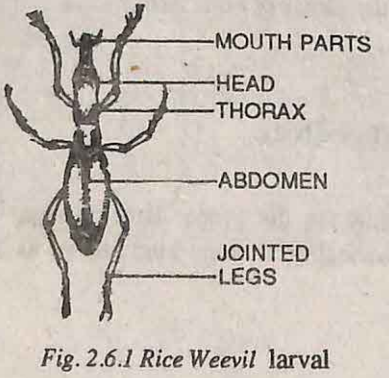


Fig. 2.6.1 Rice Weevil larval

(vi) Three pairs of jointed legs are present.

(vii) The adult female lays eggs on the grains.

(viii) These eggs develop and give rise to larval stage.

(ix) The larva possesses piercing mouth parts through which it enters the wheat grain and eats away the whole pulp of the grain so that the grain becomes hollow and lighter in weight.

(x) The larva is first converted to pupa and then to the adult inside the grain.

Out of all species of weevil, 'Rhizopertha', the weevil of wheat and 'Oryziphyllus, the rice weevil are common.

BEETLE

(i) There are several species which feed on cereal and thus cause harm to the crops.

(ii) Beetles are arthropods which are yellowish brown in colour.

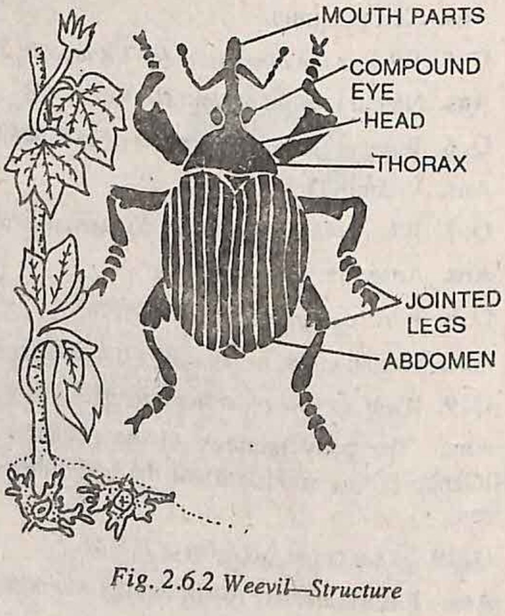


Fig. 2.6.2 Weevil—Structure

(iii) They are round or oval in shape.

(iv) The whole body of the beetle is divided into head, thorax and abdomen.

(v) Head bears a pair of eyes and needle like piercing mouth parts attached to the salivary glands.

(vi) It penetrates with its sharp and pointed mouth organs into the grain and pours its saliva to make the pulp semi-solid. Then it sucks the pulp with the proboscis present on the head.

(vii) The female beetle lays eggs on the lower surface of the leaves which on development burst open and the larvae come out.

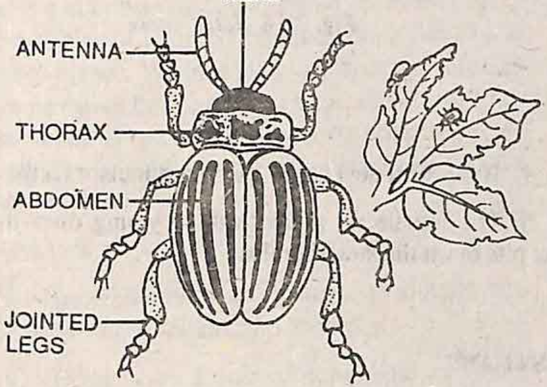


Fig. 2.6.3 Potato Beetle

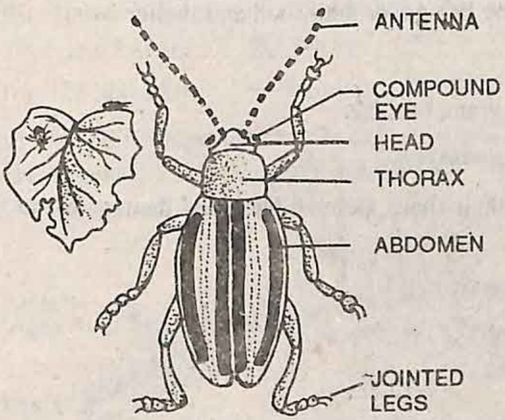


Fig. 2.6.4 Cucumber Beetle

(viii) Larva is similar to the adult in shape but devoid of wings.

(ix) After moulting the larva is converted to a pupa and then to an adult.

(x) These beetles lay in a dormant state under the heaps of dry leaves in forests in the absence of any ready ripe crops.

There are several species of beetles but red grain beetle (*Tribolium castaneum*) of pulse and groundnut, pulse beetle (*Bruchus*) potato beetle and cucumber beetle are the commonly occurring species.

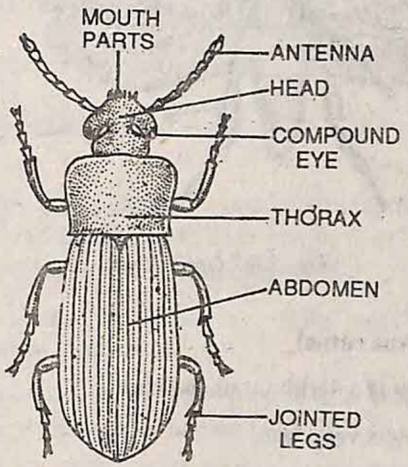


Fig. 2.6.5 Red grain Beetle

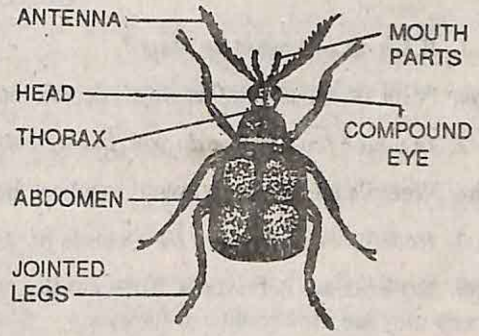


Fig. 2.6.6 Pulse Beetle

Grain Moth (Sitotroga cerealella)

(i) This moth is an arthropod, shiny and pale yellow in colour.

(ii) Its whole body is divided into head, thorax and abdomen.

(iii) There are two pairs of wings on the dorsal surface of thorax while three pairs of jointed legs are situated ventrally to the thorax.

(iv) The female lays eggs which convert into larvae.

(v) Each larva bores into the grains of millets and cereals and makes them hollow by eating away the pulp.

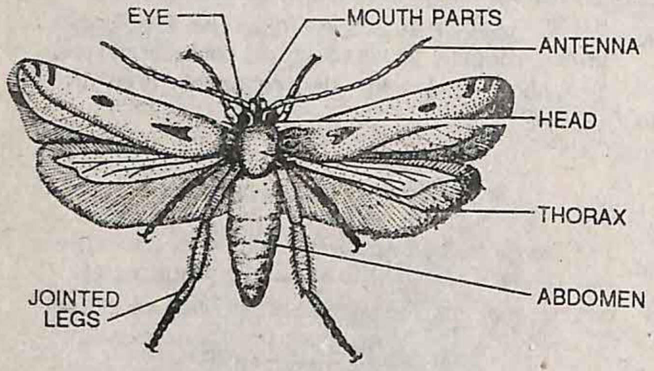


Fig. 2.6.7 Grain Moth

Rat (Ratus ratus)

1. Rat is a herbivorous mammal.

2. It runs very fast.

3. It damages the stored grains by feeding on it.

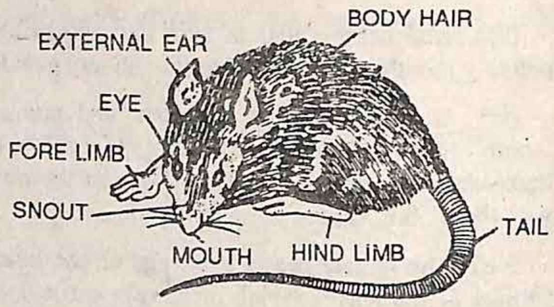


Fig. 2.6.8 Ratus ratus

4. It has well developed and sharp incisor teeth.

5. The female rat gives birth to young ones in the pits or on the stored grains.

ORAL QUESTIONS

Q. 1. *What do you mean by pests ?*

Ans. Pests are those animals which depend on other living beings for their food and shelter.

Q. 2. *In which food grains do you find weevils ?*

Ans. Weevils are generally found in wheat, barley, rice, gram, pea, etc.

Q. 3. *Rodents are said to be the enemies of farmers. Explain how ?*

Ans. Rodents are herbivores. They cut the plants with their sharp, pointed teeth and damage the crop. This way they are the enemies of farmers.

Q. 4. *Name the arthropods which are common pests of cereals.*

Ans. Weevil, beetle, grain moth etc.,are said to be the pests of crops.

Q. 5. *How do the pests attack the plants ?*

Ans. Pests either come in contact with the plant body, start eating the stem and leaves and thus damage them or they enter into the soil, bore into the roots of plants and thus attack and damage the plants.

Q. 6. *How do the pests harm the plants ?*

Ans. The pests damage the leaves, buds and stems and make them hollow. Thus the plants do not develop properly. The fruits and seeds also do not develop fully.

□□

EXPERIMENT 2.7

To identify some common vectors (at least two) and comment on their role in transmission of human diseases.

There are some animals which act as the carriers of disease carrying germs from the infected person to the normal person. These are commonly called as vectors. Some of the vectors which play an important role in transmission of human diseases are as follows :

MOSQUITO (Female Anopheles) :

It is a common mosquito found all over India. It is the carrier of malarial parasite which lives in its salivary glands. When it bites any healthy person, it pours its saliva there and then sucks the blood. Thus these malarial parasites are transferred into the human (host) body along with saliva and cause the disease malaria.

Characters :

(i) The whole body of mosquito is divided into three parts—head, thorax and abdomen.

(ii) Head bears a pair of compound eyes and mouth parts.

(iii) Thorax has a pair of wings situated dorsally and three pairs of jointed legs situated ventrally.

(iv) The abdomen is divided into ten segments.

(v) In the resting position the abdomen of the female anopheles makes right angle with the surface.

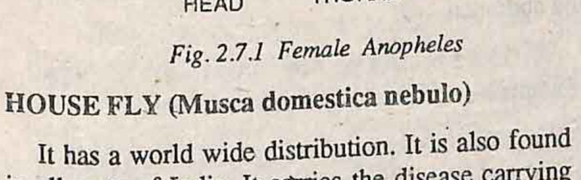


Fig. 2.7.1 Female Anopheles

HOUSE FLY (Musca domestica nebulo)

It has a world wide distribution. It is also found in all parts of India. It carries the disease carrying germs from cow dung, faeces, horse dung and other waste materials to the edible things, wounds and clothes. It carries thousands of pathogens of several types of diseases. Thus it acts as a carrier.

Characters :

(i) The body is divided into head, thorax and abdomen.

(ii) Head bears a pair of compound eyes, mouth parts, a pair of antennae and three simple eyes lying dorsally between the two compound eyes.

(iii) Mouth is placed vertically which is surrounded by mouth parts.

(iv) Thorax, the middle part of the body, is divisible in three parts or segments.

(v) There are three pairs of jointed legs situated vertically on the thorax.

(vi) There are two pairs of wings situated dorsally on the middle segment of the thorax, but only one pair remains in broad flattened form while the second pair is modified into halteres, the balancing organs.

(vii) The hind most part of the body is abdomen which is divided into 8 or 9 segments.

(viii) It is unisexual. In male, the last 3 or 4 segments are modified as the genital pouch and in female as the ovipositor.

TSE - TSE FLY (Glossina)

It is a fly generally found in the African forests. It acts as a carrier of sleeping sickness germs. The disease is known as sleeping sickness.

The sleeping sickness germs live in the body of tamed and wild animals as well as in the body of the person suffering from sleeping sickness. When the fly sucks the blood of the animal or of the patient, these pathogens enter in the alimentary

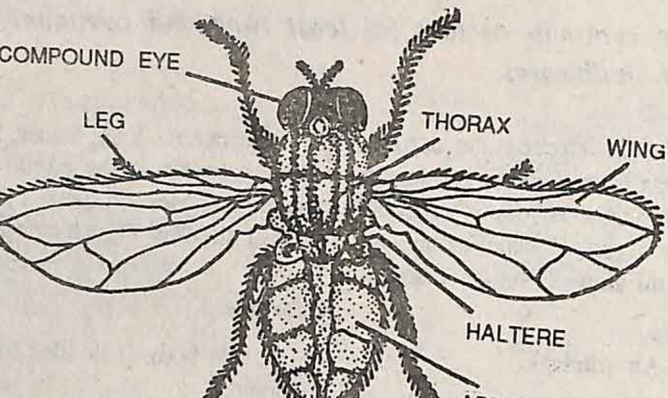


Fig. 2.7.2 Housefly

canal of the fly. There, they increase in number and reach the salivary glands. When the fly sucks the blood of a healthy person these pathogens enter in the blood stream and cause disease to the person

Characters :

(i) The whole body is divided into three main parts—head, thorax and abdomen.

(ii) Head bears a pair of compound eyes, a pair of proboscis and mouth parts.

(iii) There is a pair of wings situated dorsally on the thorax.

(iv) There are three pairs of jointed legs situated ventrally on the thorax.

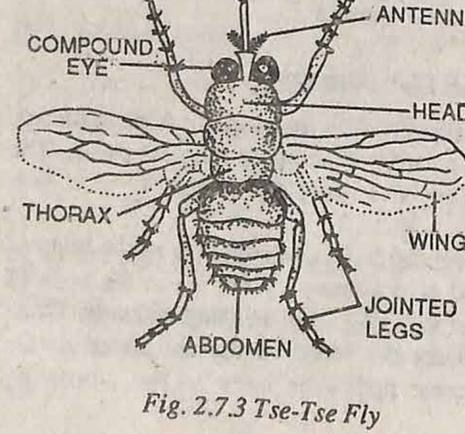


Fig. 2.7.3 Tse-Tse Fly

(v) The abdomen is divided into 8 or 9 segments.

BED BUG (Cimex)

It is found in houses, living in the joints and crevices of chairs, tables, doors, cots and other wooden furniture. It is also found in the seats of rails, buses, cinema halls, etc.

It sucks the blood of human beings in the form of its food and transmits the germs of several diseases like plague, tuberculosis etc., but this fact has not yet been confirmed. It helps in spreading the protozoal and bacterial diseases.

Characters :

(i) The bed bug is an ectoparasite on man. It sucks human blood.

(ii) It is very small in size, dark brown or red in colour.

(iii) Its body is dorso-ventrally flattened but oval in shape. It is about 5 mm long and about 3 mm broad.

(iv) The whole body is divided into head, thorax and abdomen.

(v) Head bears a pair of compound eyes, a pair of antennae and piercing compound eyes.

(vi) The thorax bears a pair of wing pads on dorsal surface but wings are absent.

(vii) Three pairs of jointed legs are situated ventrally in the thoracic region.

(viii) Abdomen is quite large and is divisible into 8 segments.

(ix) It does not fly due to the absence of the wings but runs very fast.

(x) It is nocturnal in nature.

(xi) It produces a peculiar odour from the stink gland.

FLEA (Pulex irritans)

It is an ectoparasite found on the outer surface of the skin of rats.

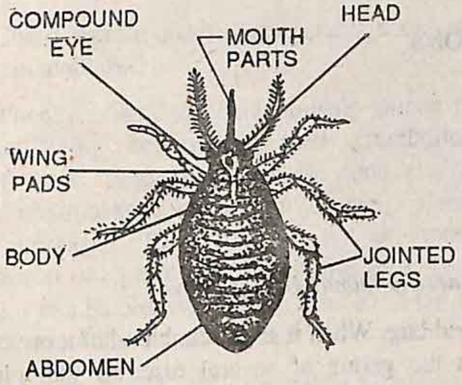


Fig. 2.7.4 Bed Bug—Structure

The flea bites the skin of rat so that wounds are formed. The flea passes out its faeces on the wound and rubs it. The germs live in the faeces of the flea which on rubbing enter in the body of rat. Thus the rat gets injected with plague. When the germs multiply, the infected rat's condition becomes critical. Ultimately the rat does not survive for a long time.

The germs causing plague are known as *Piturella pestis*. These live in the stomach of flea and then reach the salivary gland.

When the flea bites a healthy person these pathogens reach the blood stream of man which on developing and multiplying increase their number and cause the disease. Thus the infected person starts showing the symtoms of plague.

Characters

(i) Flea is an ectoparasite, redish-white brownish white in colour.

(ii) It is about 1·5 mm in length.

(iii) Its whole body is divided into head, thorax and abdomen.

(iv) Head bears a pair of eyes, a pair of antennae and mouth organs which can pierce in the skin.

(v) Wings on the thorax are absent, therefore, it does not fly but it moves by jumping.

(vi) There are three pairs of jointed legs ventrally situated in the thoracic region.

(vii) It lays eggs on heaps of rubbish, in the joints of walls and floor.

(viii) The eggs are converted into larvae and then into pupae and ultimately into adults in a month's time.

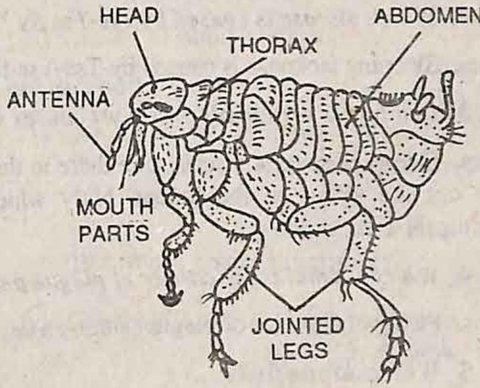


Fig. 2.7.5 Flea—Structure

TICK

Ticks are the ectoparasite of cows, buffaloes, horses, dogs etc. These are the carriers of germs causing recurrent fever and reckettsiosis pathogens and other germs.

These germs are transferred from the ticks to the cattle's body where they suck blood and multiply, increasing their number. Thus they spread the disease. These germs also increase their number in the tick's body and are transferred into the cattle's body while sucking the host's blood.

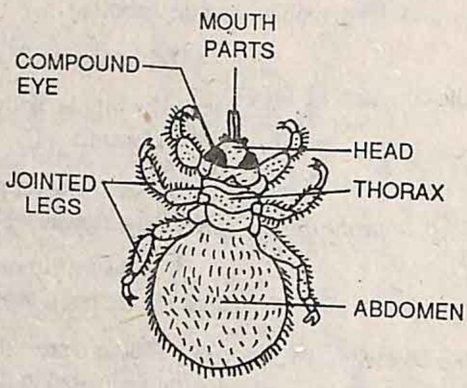


Fig. 2.7.6 Tick—Structure

ORAL QUESTIONS

Q. 1. *Which animal is the carrier of Plasmodium ?*

Ans. The female anopheles mosquito is the carrier of plasmodium.

Q. 2. *Which disease is caused by Tse-Tse fly ?*

Ans. Sleeping sickness is caused by Tse-Tse fly.

Q. 3. *Bed bug is very small in size yet causes serious sickness to human beings. How ?*

Ans. Germs of several diseases are there in the body of bed bug. When it sucks the blood of a person, it oozes out the saliva in the human body which contains the germs of several diseases like plague, tuberculosis etc.

Q. 4. *Which animal is the carrier of plague pathogen ?*

Ans. Flea is the carrier of plague pathogen *i.e., Piturella pestis.*

Q. 5. *Where do you find ticks ?*

Ans. Ticks are generally present on the outer body surface of cows, buffaloes, horses, etc.

□□

UNIT 3

ENVIRONMENT

EXPERIMENT 3.1

To reconstruct food chains from the given specimens/pictures of organisms.

Required Material : Museum specimens of producers (green plants). Primary consumers like insects, rat, rabbit, deer, worms. Secondary consumers like frog, lizards, wolf, tiger, lion etc. Tertiary consumers like snake, hawks, etc.

Charts can be taken if specimens of the animals are not available.

Theory : A kind of relationship among two or more living beings for their food forms a continuous chain known as the food chain. The food chain always starts from the green plants, *i.e.*, the producers. There may be one or more food chains at one place or in a definite area. The food chains can be observed not only on earth but also in fresh water and marine water.

Procedure : Visit your area at all places. You can notice that all animals and plants live together depending on each other for their food. Make a link among them. One living organism can be included in more than one food chain. Some common terrestrial food chains are given as follows :

Terrestrial Food Chain :

(1) Green plants (herbs) → Insects → Frog → Snake → Peacock.

(2) Green plants or Grass → Insect → Garden-lizard.

(3) Grass → Goat → Lion

(4) Grass → Goat → Man

(5) Grass → Deer → Lion

(6) Grass → Rabbit → Tiger

Aquatic Food Chain :

(1) Green hydrophytic plants (Algae) →
Hydrozoa (aquatic insects)
↓
Aquatic bird ← Frog
(like Swan, Duck, Kingfisher)

(2) Green hydrophytic plants (Algae) →
Hydrozoa (Aquatic insects)
↓
Large fish ← small fish

ORAL QUESTIONS

Q. 1. *Fill in the blank numbered spaces in the following :*

$\boxed{1.} \rightarrow \text{Deer} \rightarrow \boxed{2.} \rightarrow$

Ans. 1. Grass 2. Lion

Q. 2. *What do you mean by an aquatic chain ?*

Ans. An aquatic chain is the food chain which starts in fresh water and is completed there.

Q. 3. *Fill in the numbered spaces of the following :*

$\text{Hydrophytic plants} \rightarrow \boxed{1.} \rightarrow \text{Frog} \rightarrow \boxed{2.}$

Ans. 1. Aquatic insects 2. Aquatic birds.

EXPERIMENT 3.2

To provide missing link in the given food chains.

Required Materials : Museum specimens of producer like green plants, primary consumers like insects, rats, rabbit, deer, worms. Secondary consumers like frog, lizard, wolf, tiger, lion etc. Tertiary consumers like snake, hawks, etc.

Charts and models can be taken if actual specimens are not available.

Theory : A systematic relation among the living organisms for food is known as food chain. Food chain starts from producers and ends on tertiary consumers. The link among the organisms in the food chain is systematic. If any one link is missed, the whole food chain will be disturbed. The effect of the missing link can be explained with the examples given below :

Procedure : Prepare a food chain with the help of the provided material. Find the importance of each link.

Example 1, Terrestrial food chain.

Green plants→ ☐ →Frog→Snake→Peacock

Observation :

1. Look at the above example of food chain and find the organism missed on the blank space.

2. Do you think that the missing organism in the blank space is a must or the food chain can be completed without that missing link ?

Write the answers of both the above questions in your practical file yourself in the result column..

Write the name of missing link in the following given examples and also write the importance of that missing link (organism) in completing the food chain.

Example 2.

Grass → ☐ → Garden lizard.

Example 3.

Grass → ☐ → Tiger.

Example 4.

Grass → Deer → ☐

Result : In example 1 the missing link is "Insect" the primary consumer.

In the absence of primary consumer the entire food chain will be disturbed.

Similarly write the results of examples 2, 3 and 4.

ORAL QUESTIONS

Q. 1. *What is a producer ?*

Ans. A producer is that living being which manufactures complex organic food material from the raw material.

Q. 2. *What is a primary consumer ?*

Ans. A primary consumer is that animal which eats the plants, the producers.

Q. 3. *What are the secondary and tertiary consumers ?*

Ans. Secondary consumer is that animal which eats the herbivores in the form of food. Tertiary consumer is that which eats the herbivore and the secondary consumers.

Q. 4. *What do you mean by food chain ?*

Ans. The relation of the living beings with other living beings on the basis of food forming a long chain is known as food chain.

□ □

EXPERIMENT 3.3

To provide missing link in various mineral cycles.

Required Material : Charts, models related to various mineral cycles like Phosphorus cycle, Calcium cycle, Water cycle, Carbon cycle, Nitrogen cycle, Hydrogen cycle and Oxygen cycle, etc.

Theory : There are various non-living substances which make up the protoplasm and other body tissues. They are also helpful in organising many vital processes. They are known as mineral nutrients. Some nutrients are needed in large quantity so they are termed macro nutrients while some others are needed in very less quantity so they are termed as micro nutrients.

Some macro nutrients are Carbon, Nitrogen, Hydrogen and Oxygen which are found in nature in free state while some other are Calcium, Phosphorus, Water, Sulphur etc., are obtained from earth.

Procedure : Study all these cycles one by one separately.

1. Draw one cycle in your practical file.

2. Make a circular or rectangular boundary on each important link.

3. Omit any one of the links so that one is missed.

4. Find out the consequences of omitting or missing that particular link on the whole cycle.

Result : On the basis of above observations it is seen that the carbon cycle will be disturbed. It shows the importance of producers in the carbon cycle.

You can also find out the result by omitting or missing any other link in the cycle.

EXPERIMENT 3.3 (a)

To provide missing link in the Carbon Cycle.

Required Material :

Chart of carbon cycle, pencil, eraser, practical file.

Observations :

Let one link (plants *i.e.*, producer) be missing in the cycle.

Find out the consequences of its missing on the rest of the links of the cycle. You will find that :

(i) Herbivores will die due to starvation.

(ii) The carnivores *i.e.*, secondary and tertiary consumers will also die due to the absence of primary consumers (herbivores).

(iii) Amount of CO_2 will increase in the atmosphere vigorously.

(iv) Amount of O_2 present in the atmosphere will be consumed rapidly.

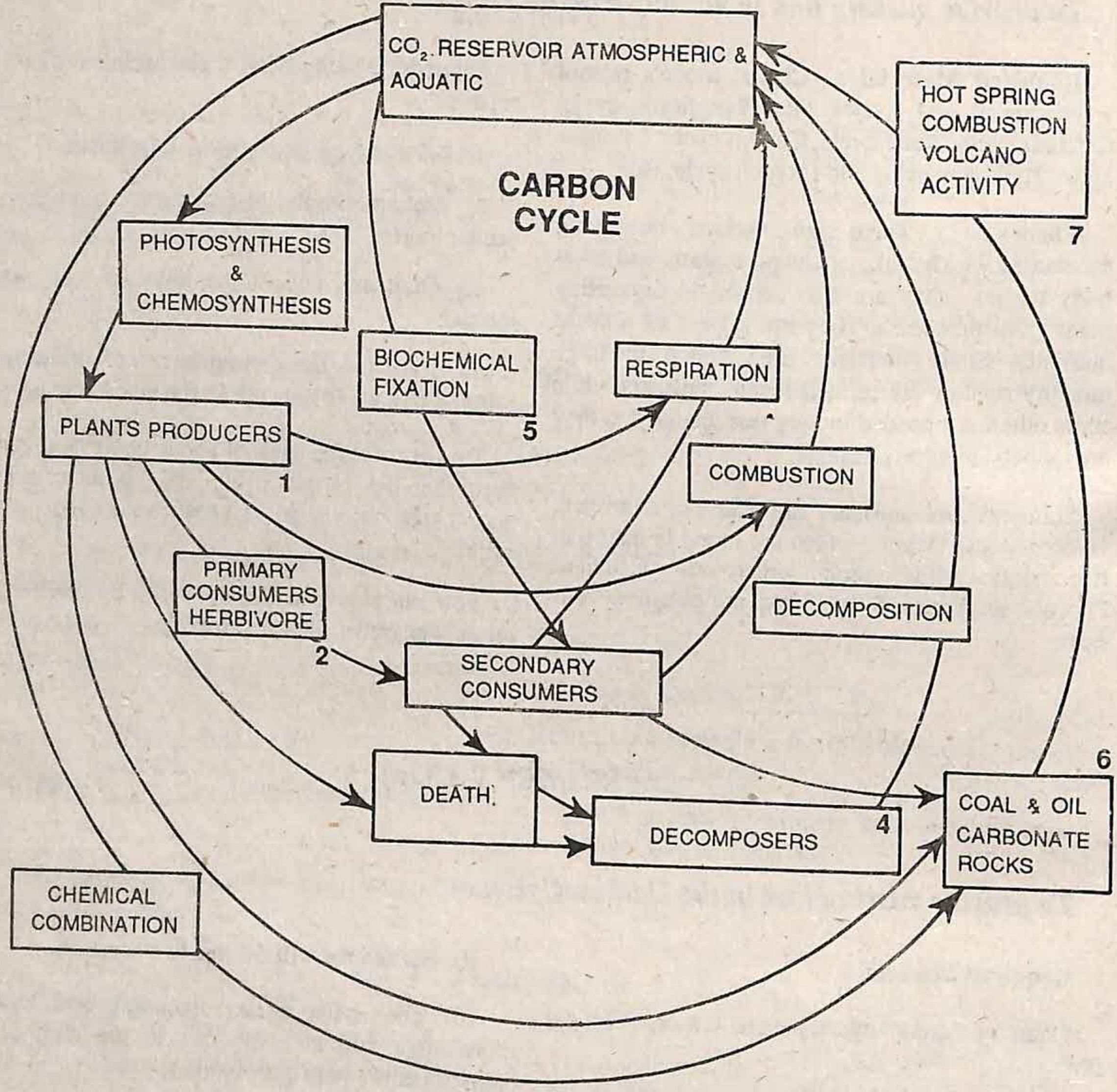

CO2 RESERVOIR ATMOSPHERIC & AQUATIC
HOT SPRING COMBUSTION VOLCANO ACTIVITY
7
CARBON CYCLE
PHOTOSYNTHESIS & CHEMOSYNTHESIS
BIOCHEMICAL FIXATION
5
RESPIRATION
PLANTS PRODUCERS
1
COMBUSTION
PRIMARY CONSUMERS HERBIVORE
2
DECOMPOSITION
SECONDARY CONSUMERS
6
DEATH
DECOMPOSERS
4
COAL & OIL CARBONATE ROCKS
CHEMICAL COMBINATION

Fig. 3.3 (a) Carbon Cycle.

EXPERIMENT 3.3 (b)

To provide missing link in the Nitrogen Cycle.

Required Material : Chart of nitrogen cycle, pencil, eraser, practical file.

Observations :

(i) In the given Nitrogen cycle Fig. 3.3 *(b)* four important links are numbered.

(ii) Omit *i.e.,* miss any one of these four.

(iii) Find the consequences on other links by missing that particular link.

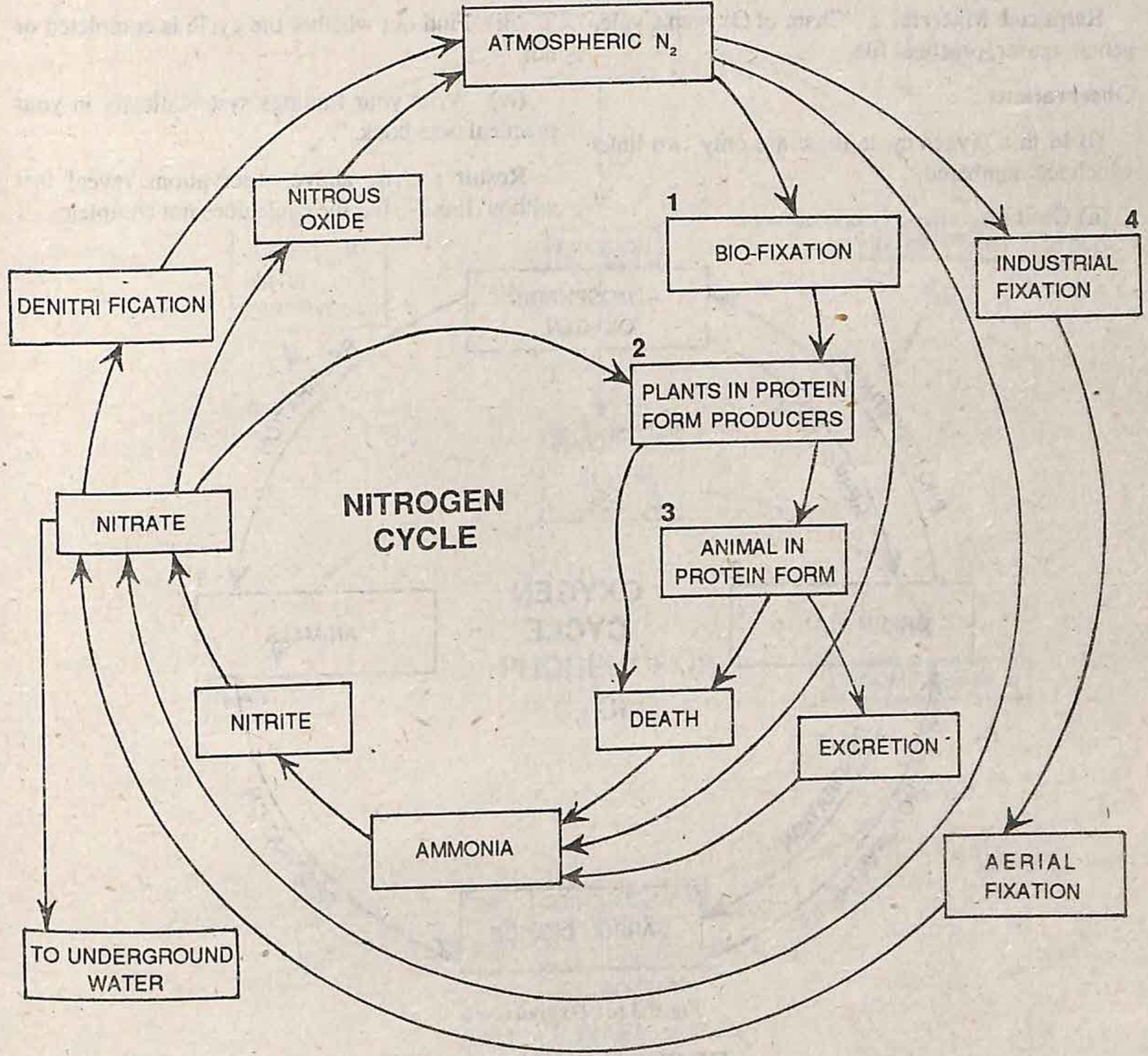


Fig. 3.3 (b) Nitrogen Cycle.

(iv) Can this cycle be completed by missing that link ?

(v) Write your result in the next step.

Result : The missing link No......,shows that the cycle does not complete which reflects that the presence of the particular link is essential in Nitrogen Cycle.

EXPERIMENT 3.3 (c)

To provide missing link in the Oxygen Cycle.

Required Material : Chart of Oxygen Cycle, pencil, eraser, practical file.

Observations :

(i) In the Oxygen cycle there are only two links which are numbered.

(ii) Omit *i.e.,* miss any one of them.

(iii) Find out whether the cycle is completed or not.

(iv) Write your findings systematically in your practical note book.

Result : The above observations reveal that without link No....., the cycle does not complete.

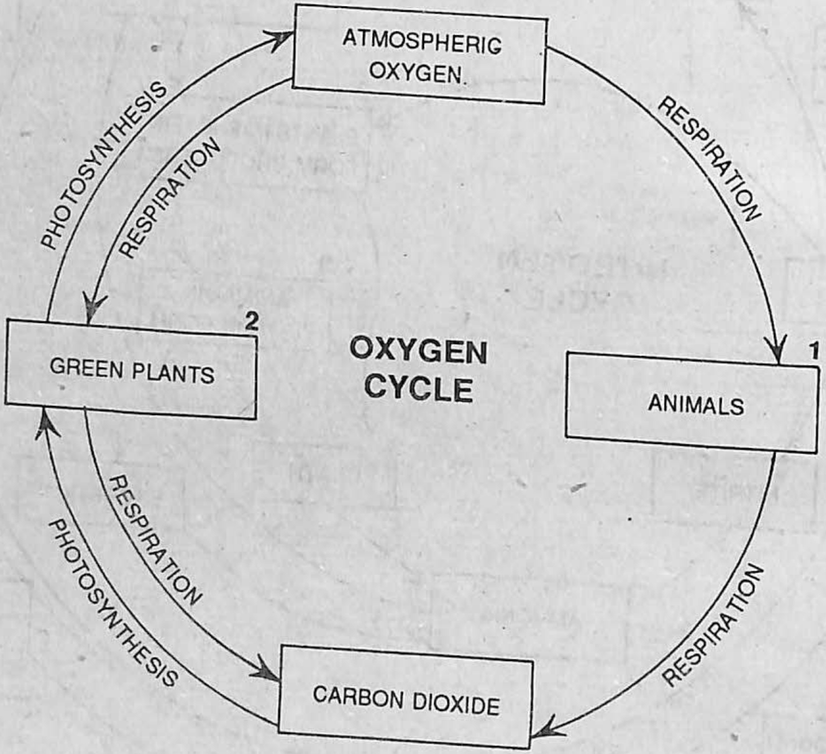


Fig. 3.3 (c) Oxygen Cycle

EXPERIMENT 3.3 (d)

To provide missing link in the Phosphorus Cycle.

Required Material : Chart of Phosphorus cycle, pencil, eraser, practical file.

Observations :

(i) Draw the phosphorus cycle in your practical file.

(ii) Omit *i.e.,* miss any one link.

(iii) Observe whether the cycle is completed or not.

(iv) Write your findings systematically in your practical note book.

Result : The above observations show that without link No........., the cycle does not complete.

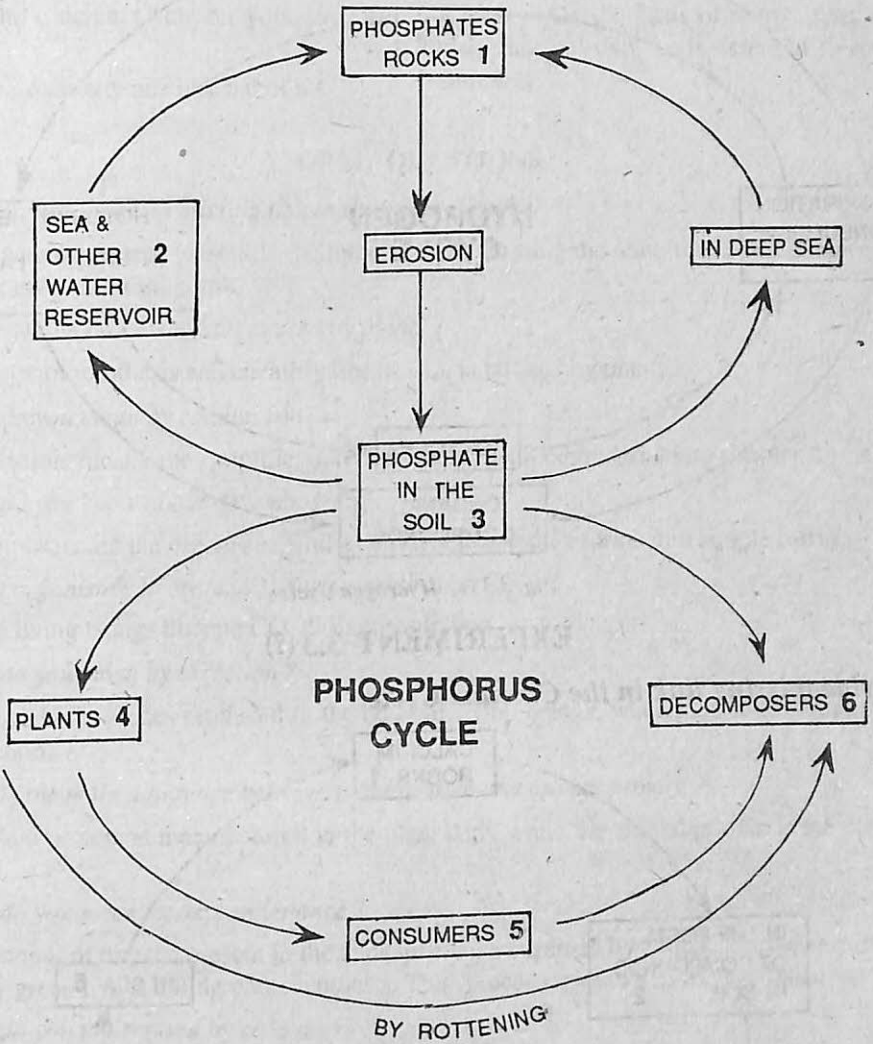


Fig. 3.3 (d) Phosphorus Cycle

EXPERIMENT 3.3 (e)

To provide missing link in the Hydrogen Cycle.

Required Material : Chart. of Hydrogen Cycle, pencil, eraser, practical file.

Observations :

(i) Draw the Hydrogen cycle on your practical record file.

(ii) Omit *i.e.,* miss any one link out of all.

(iii) Find out whether the cycle is completed or not.

(iv) Write your findings systematically in your practical note book.

Result : On the basis of above observations it is clear that without link No......., the cycle does not complete.

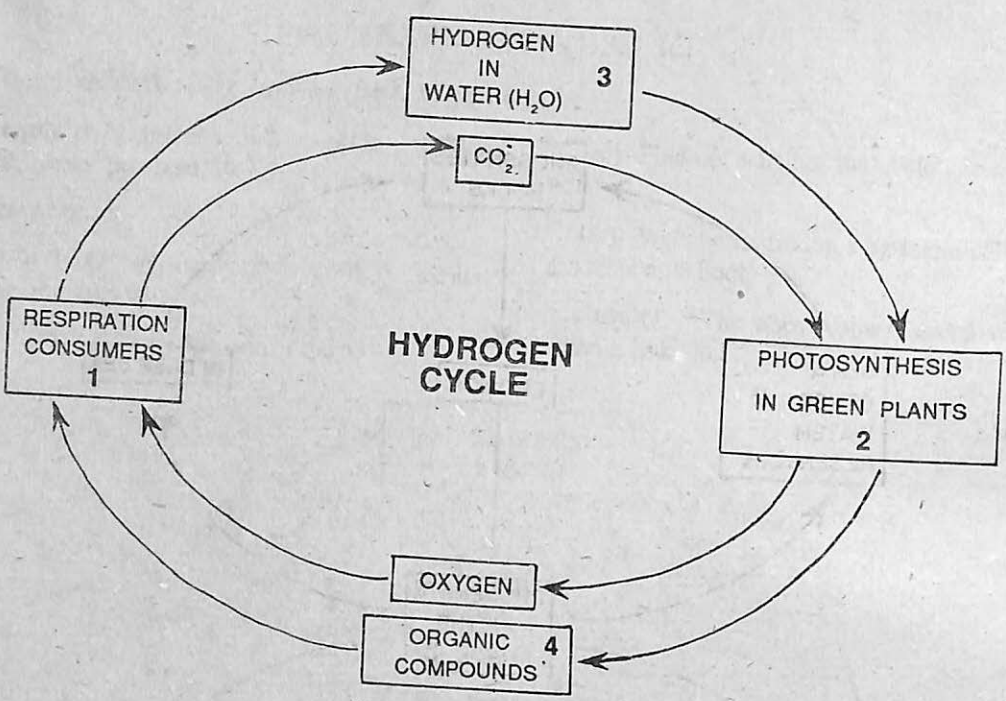


Fig. 3.3 (e) Hydrogen Cycle

EXPERIMENT 3.3 (f)

To provide missing link in the Calcium Cycle.

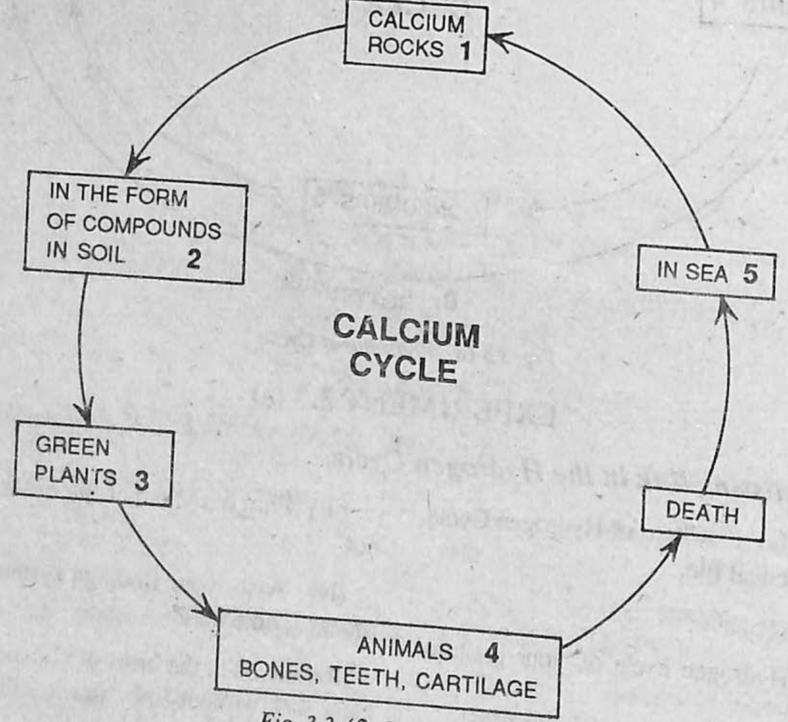


Fig. 3.3 (f) Calcium Cycle

Required Material : Chart of Calcium Cycle, pencil, eraser, practical file.

Observations :

(i) Draw the Calcium Cycle on your practical record file.

(ii) Omit *i.e.*, miss any one link out of all.

(iii) Find the effect of its absence on other links.

(iv) Write your findings systematically.

Result : On the basis of above observations, it is clear that link No...... is essential to run this cycle smoothly.

ORAL QUESTIONS

Q. 1. *What do you mean by missing link in the mineral cycle ?*

Ans. Link means the steps present in the mineral cycle forming the continuity. The absence of any step in the cycle is known as missing link.

Q. 2. *Under which processes CO_2 is used by plants ?*

Ans. During photosynthesis and chemosynthesis CO_2 is utilized by plants.

Q. 3. *What do you mean by combustion ?*

Ans. Combustion means the simplification of the complex food material into simpler forms.

Q. 4. *What do you know about decomposers ?*

Ans. Decomposers are the organisms which convert the complex forms into simple forms.

Q. 5. *Which organisms liberate CO_2 during respiration ?*

Ans. All the living beings liberate CO_2 during respiration.

Q. 6. *What do you mean by excretion ?*

Ans. The metabolic wastes produced in the body of living beings, when passed out from the body are known as excretion.

Q. 7. *What is the main difference between plant protein and animal protein ?*

Ans. The plant protein is manufactured in the plant body while the animal protein is the complex form of plant protein.

Q. 8. *What do you mean by oxygen balance ?*

Ans. The amount of oxygen present in the atmosphere is consumed by animals during respiration which is reobtained by green plants during photosynthesis. This process is known as oxygen balance.

Q. 9. *What do you understand by consumers ?*

Ans. The living being which utilizes phosphorus in any form is called consumer.

Q. 10. *How is hydrogen utilized by the living beings ?*

Ans. Living beings utilize hydrogen gas in the form of water and organic compounds.

Q. 11. *What is the use of calcium in human body ?*

Ans. Calcium is present in human body in the form of bones, cartilage, teeth etc.

Q. 12. *In which forms is calcium present in the sea ?*

Ans. Calcium is found in the sea in the form of calcareous exoskeleton, skeletons of marine animals and skeletons of molluscs, etc.

EXPERIMENT 3.4

Experiment to show that green plants synthesize carbohydrates.

Required Material : One potted plant of varigated leaf *i.e.,* pothos (money plant), or two plants one plant having green leaves and the other plant having purple coloured leaves (Rhoeo), clean water, amyl alcohol, test tubes, spirit lamp, dilute Iodine solution.

Procedure : Put the provided plants in the sun for a few hours. Now take a purple leaf and one green leaf. Boil them separately in water for 5 minutes and then put them separately into 60% amyl alcohol at 60°C. The leaves turn colourless.

Now take out the leaves and wash them with cold water.

Now pour 3 or 4 drops of dilute Iodine solution and observe the leaves.

Observation : The rhoeo leaf did not turn blue while the green leaf turned dark blue.

Result : On the basis of observations it is clear that starch (carbohydrate) is formed in green leaf while it was not formed in the rhoeo leaf.

Note : Sugar and starch are the modified but simpler forms of carbohydrates.

ORAL QUESTIONS

Q. 1. *How is carbohydrate formed in plants ?*

Ans. Carbohydrate is formed in plants during photosynthesis.

Q. 2. *What are the basic constituents of carbohydrates ?*

Ans. Carbon, hydrogen and oxygen are the basic constituents of carbohydrates.

Q. 3. *Do you find carbohydrate in non-green leaves ?*

Ans. No, carbohydrate is absent in non-green leaves.

Q. 4. *How do the non-green plants compensate the deficiency of carbohydrate ?*

Ans. Non-green plants receive carbohydrate or its simpler forms from earth to compensate the need of carbohydrates.

□□

UNIT 4

NATURAL RESOURCES

Introduction:

We come across so many things in our daily life which are associated with the science of chemistry. Hence it becomes quite essential that the students must know about chemistry. They must observe the practical uses of chemistry in their day-to-day life. For example pollution which is a current problem of today. There are various types of pollution about which the students should know. They should know about things like compost. How is it prepared ? How can it be utilized in a proper way ? The students should know that water is an important constituent for both the animal kingdom and plant kingdom. They should know how to find out the percentage of water in various plant materials. The students must know about hard water and soft water. They must know the causes of hardness of water and how it is converted to soft water.

It becomes quite essential that the students must be given a chance to work in a chemistry laboratory. The chemistry laboratory is a part of the school building where the students do the experiments with their own hands and try to understand the things about which they come across in their everyday life. This will enable the students to learn the things better and create an interest in them in the science of chemistry.

Some Important Things used in a Chemistry Laboratory

Gas Supply Taps and Bunsen Burners : Gas to be used in Bunsen burners is supplied through the gas taps provided at the working table.

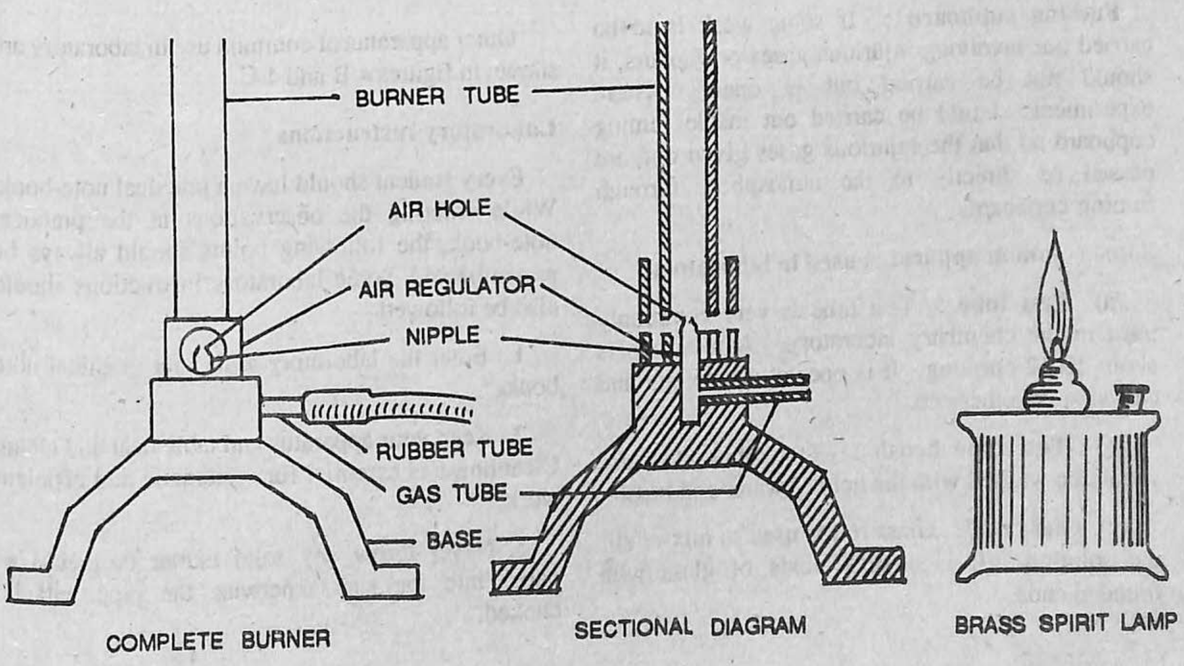


Fig. 4 A. Bunsen Burner

The gas supply taps should be closed as soon as the work is finished to avoid any accident. Length of the flame can be controlled by altering the amount of gas supplied through the gas taps.

Water taps : Water taps are provided at each working table so that the test tubes, beakers, flasks etc., can be washed after using them. They should never be left unwashed otherwise they are spoiled. Water from chemistry laboratory should never be taken as it may contain undesirable substances.

Shelves for keeping the reagents

Shelves are provided at every working table to keep the reagent bottles. Reagent bottles should be placed at proper place after use. Stoppers should also be inserted after using the reagent bottles.

Sink : Sinks are provided at each working table to allow the flow of waste liquid. Filter papers should not be thrown in the sink as they block the outlets for liquids.

Waste box : Waste boxes are placed beneath every laboratory table. Filter paper pieces, broken glass tubes etc., should be thrown in waste boxes. No burning paper or match stick should be thrown in waste box.

Fuming cupboard : If some work is to be carried out involving injurious gases or vapours, it should not be carried out in open. These experiments should be carried out inside fuming cupboard so that the injurious gases given out, are passed on directly to the atmosphere through fuming cupboards.

Some common apparatus used in laboratory

(a) **Test tube** : Test tube is very commonly used in the chemistry laboratory. A test tube is about 10-12 cm long. It is opened at one end and closed at the other end.

(b) **Test tube brush :** Test tubes after use should be washed with the help of water and brush.

(c) **Glass rod :** Glass rod is used to mix or stir the solution. It is a stick made of glass with rounded ends.

(d) **Tripod stand :** Tripod stand is made of iron and it possesses three legs. It is used to heat the liquid. A wire gauze is placed on the tripod stand. A beaker or a flask containing the solution is placed on the wire gauze. The burner is placed below the wire gauze.

(e) **Test tube holder :** While heating the solutions in test tubes, test tube holders are used to hold them.

(f) **Beakers :** Beakers are generally made of glass. They have a cylindrical shape. They have different capacities, generally 100 ml, 250 ml, 500 ml and 1000 ml. Beakers may be used for heating the solutions or storing the liquids.

(g) **Condensers :** They are generally used when distillation is carried out. Condensers are generally long glass tubes bent at both the ends. Middle portion of the glass tube is surrounded by a glass jacket. The glass jacket has two openings, one at lower end and the other at the upper end. Water is made to enter from the lower end and passes out from the upper end.

Condensers are generally used to cool the vapours passing through inner tube.

Other apparatus of common use in laboratory are shown in figures 4 B and 4 C.

Laboratory Instructions

Every student should have a practical note-book. While entering the observations in the practical note-book, the following points should always be remembered. Some laboratory instructions should also be followed.

1. Enter the laboratory with your practical note-book.

2. Keep your apparatus and table neat and clean. Cleanliness is essential for systematic and efficient work.

3. Never throw any solid matter or pieces of paper into the sink otherwise the pipe will be choked.

4. Never take away the reagent bottle placed in the common shelf to your seat.

5. Avoid talking, whispering, or moving about in the laboratory.

6. No substance should be tasted without permission.

7. Always enter your observations directly into the note-book.

8. Put the date on which the work was carried out. Don't forget to write the serial number of the experiments.

9. Never consult your neighbour otherwise you may be misled.

10. Record the observations and calculations on the left-hand side of the note-book.

11. Try to write chemical equations where and when necessary.

12. Don't remove the pages from the note-book.

13. When the practical is over, get your note-book signed by the teacher.

□□

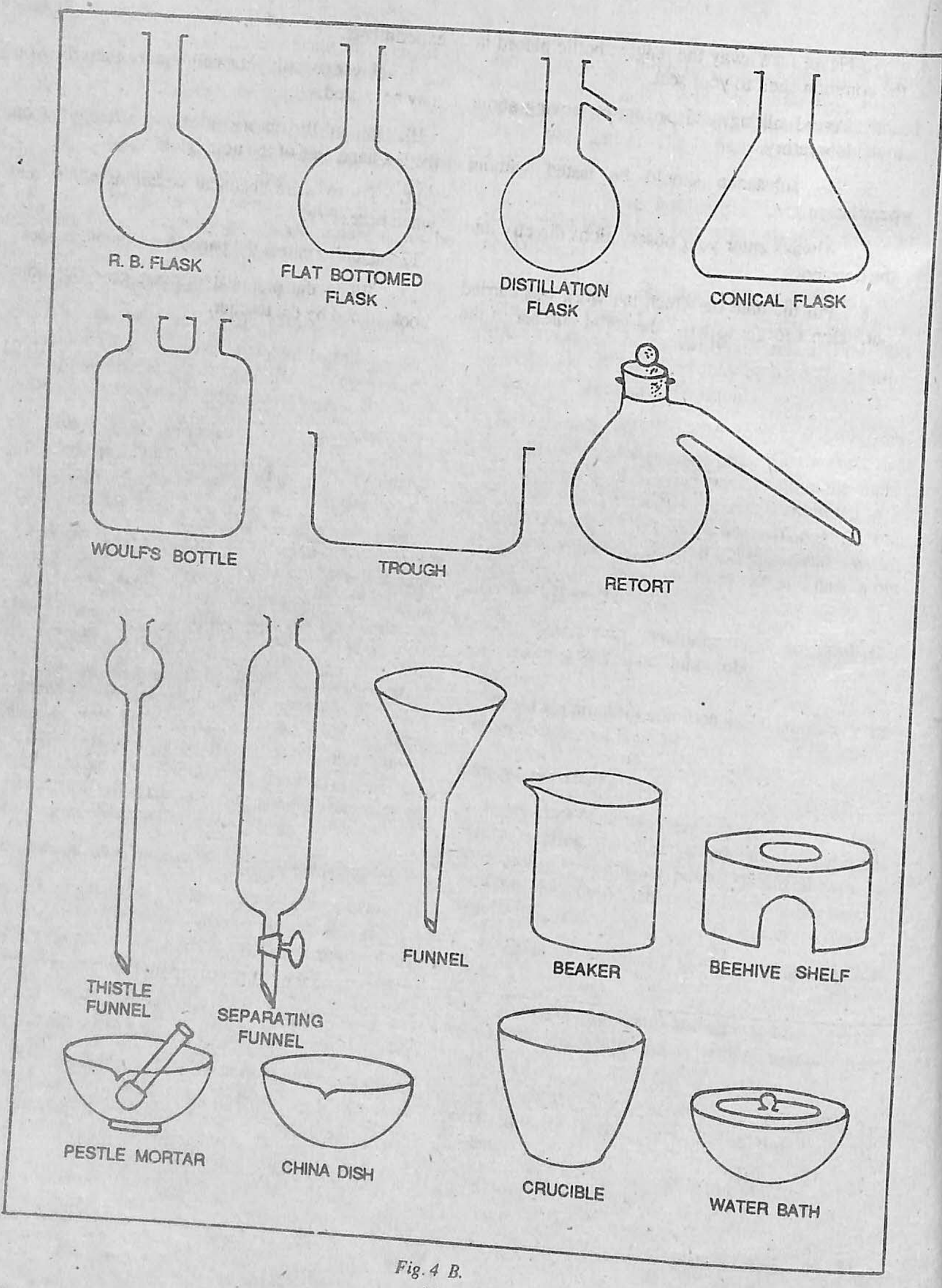

R. B. FLASK
FLAT BOTTOMED FLASK
DISTILLATION FLASK
CONICAL FLASK
WOULF'S BOTTLE
TROUGH
RETORT
THISTLE FUNNEL
SEPARATING FUNNEL
FUNNEL
BEAKER
BEEHIVE SHELF
PESTLE MORTAR
CHINA DISH
CRUCIBLE
WATER BATH

Fig. 4 B.

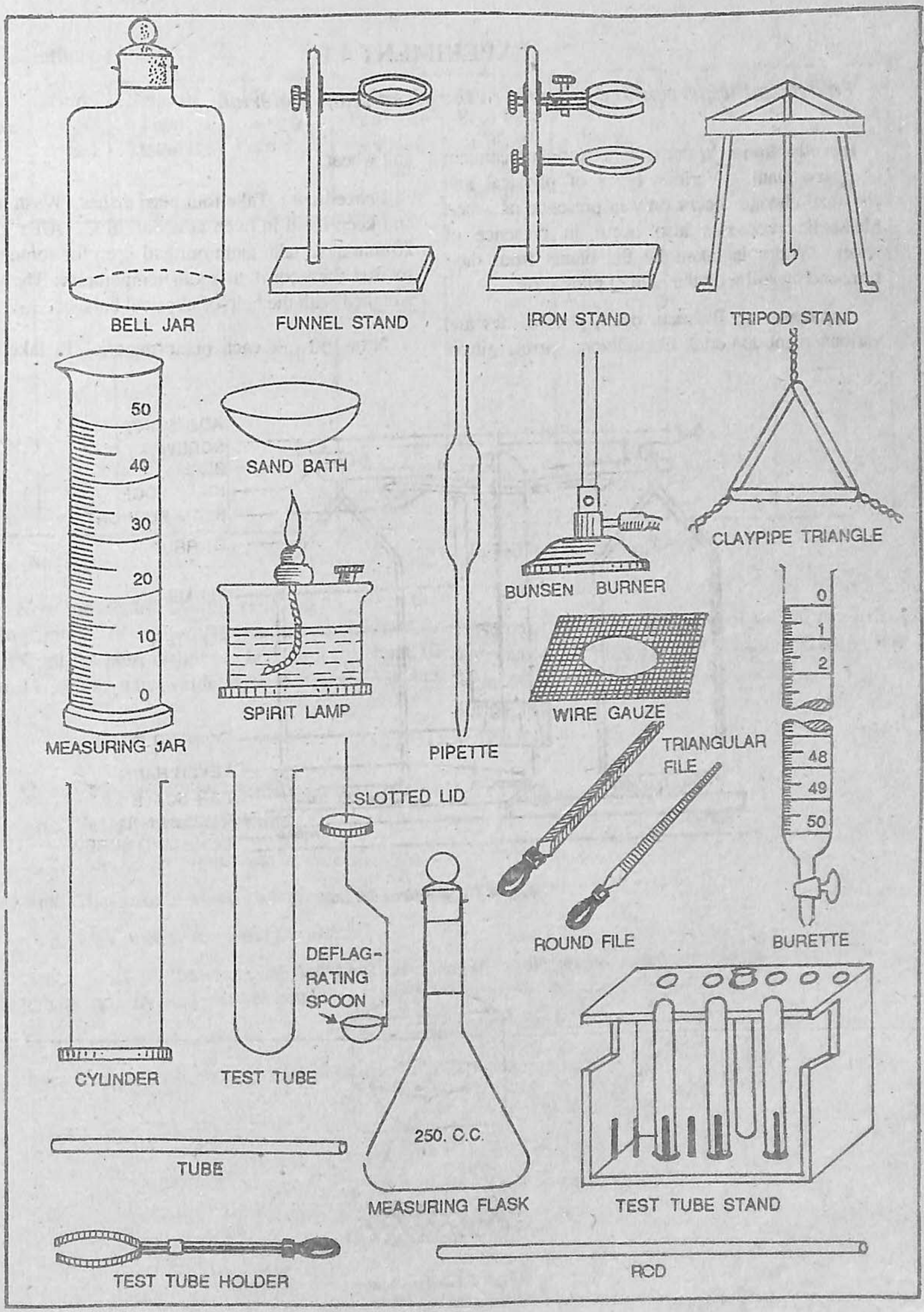

BELL JAR
FUNNEL STAND
IRON STAND
TRIPOD STAND
MEASURING JAR
50
40
30
20
10
0
SAND BATH
SPIRIT LAMP
PIPETTE
BUNSEN BURNER
CLAYPIPE TRIANGLE
WIRE GAUZE
0
1
2
48
49
50
BURETTE
TRIANGULAR FILE
ROUND FILE
SLOTTED LID
DEFLAG-RATING SPOON
CYLINDER
TEST TUBE
TUBE
250. C.C.
MEASURING FLASK
TEST TUBE STAND
TEST TUBE HOLDER
ROD

Fig. 4 C.

EXPERIMENT 4.1

To determine percentage of water in the given plant material.

Introduction : Water is an essential constituent of every plant. Various types of physical and chemical changes occur only in presence of water. Metabolic processes also occur in presence of water. Water is taken by the plants from their surrounding soil with the help of plant roots.

Apparatus : Balance, oven, petri dishes and various plant material like melon, carrot, ginger and wheat.

Procedure : Take four petri dishes. Wash them and keep them in oven at about 70°C. After 15 to 20 minutes, take them out and keep for some time so that they come to room temperature. They are weighed with the help of physical balance.

Now 150 g of each plant material is taken in

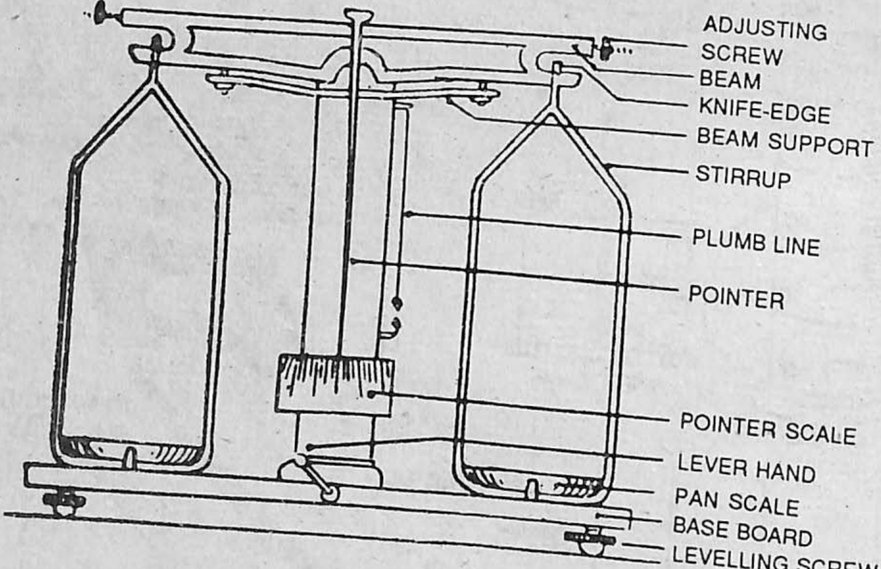


Fig. 4.1.1 Physical Balance

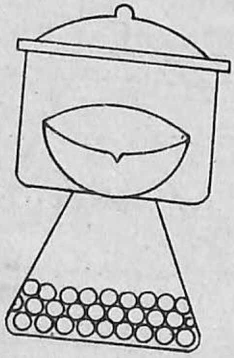


Fig. 4.1.2 Dessicator

Observations :

S. No.	Petri dish No.	Name of Plant Material	Mass of Empty Petri dish	Mass of Petri dish + Plant before heating	Mass of Petri dish + Plant after heating	Mass of Plant before heating	Mass of Plant after heating	Mass of water present in 100 g of Plant
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								

the petri dishes.

Now the electric oven is switched on. When the temperature of the oven reaches approximately 80°C all the petri dishes are kept in it for about 10 to 11 hours. Afterwards they are taken out and cooled in a desicator (See Fig. 4.1.2)

Conclusion :

(Name of Plant) has least loss of weight due to loss of water on heating. Hence (Name of Plant) has least percentage of water.

ORAL QUESTIONS

Q. 1. *Do plants contain water ?*

Ans. Yes, plants contain water.

Q. 2. *How do the plants take in water ?*

Ans. They take in water from the soil surrounding it through their root system.

Q. 3. *Why is water essential for plants ?*

Ans. Most of the chemical and physical changes in the plants occur only in presence of water. Metabolic activity also requires water.

Q. 4. *Is water necessary for photosynthesis in plants ?*

Ans. Yes, water is necessary for photosynthesis in plants.

□□

EXPERIMENT 4.2

To prepare saturated solutions of common salt and sugar.

Introduction : Whenever two or more substances are mixed up together, a solution is formed. Solutions are of two types:

(i) Heterogeneous (ii) Homogeneous

(i) Heterogeneous Solutions : Those solutions in which various components making up the solution are not well mixed up are known as Heterogeneous solutions, for example sand and water. (see Fig. 4.2.1).

(ii) Homogeneous Solutions : For those solutions in which various components making up the solution are well mixed up so that only one uniform phase is formed are known as homogeneous solutions. For example sugar is dissolved in water. They are also known as *true solutions* (Fig. 4.2.2). True solutions are of two types.

(i) Unsaturated solution (ii) Saturated solution

(i) Unsaturated solutions are those solutions in which more of the solute can be dissolved at a particular temperature.

(ii) Saturated solutions are those solutions in which no more of the solute can be dissolved at a particular temperature.

Apparatus : Beaker, glass rods, graduated cylinders, thermometer, distilled water, common salt and sugar.

Procedure : Clean two beakers and take about 200 ml of distilled water in both. Now add about 2 g of sugar to one of the beaker and stir it with the help of a glass rod. If the sugar dissolves, add again about 2 g of sugar and stir the solution. In this way go on adding sugar till some of it is left undissolved at the bottom. The final solution will be a saturated solution of sugar. Similarly one can prepare saturated solution of sodium chloride (common salt) also.

Precautions : Temperature should be kept constant throughout the experiment.

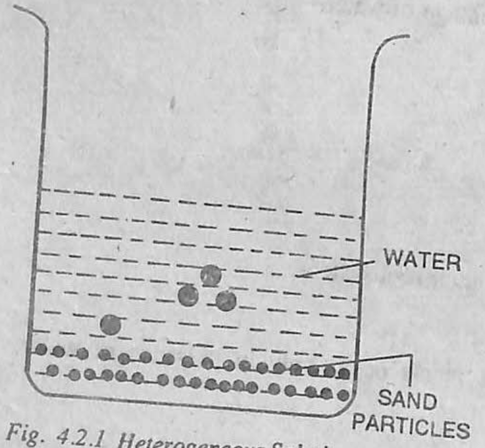


Fig. 4.2.1 Heterogeneous Solution

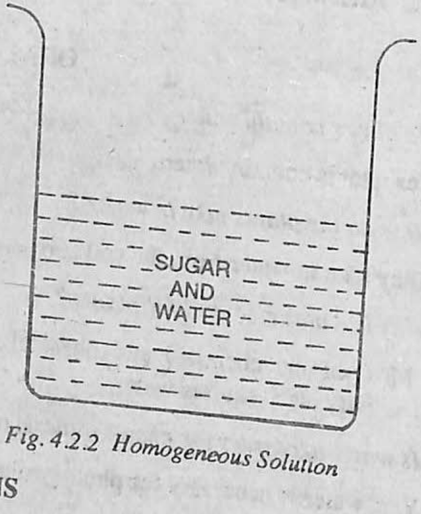


Fig. 4.2.2 Homogeneous Solution

ORAL QUESTIONS

Q. 1. *Define solubility of a substance.*

Ans. Solubility is defined as the amount of solute present in a saturated solution at constant temperature.

Q. 2. *What are the units in which the solubility of a substance is expressed ?*

Ans. It is expressed in terms of g of solute present in 100 g of solvent. It is also expressed in moles/litre.

Q. 3. *How does temperature affect solubility ?*

Ans. Solubility of a solute increases with increase of temperature except a few solutes such as sodium chloride (common salt).

EXPERIMENT 4.3

To prepare solutions of various substances and identify them as true solutions and suspensions.

Introduction : When two substances are mixed up together, a solution is formed. If the two substances are well mixed up and only one uniform phase is obtained, the solution is called homogeneous if not then it is heterogeneous. Thus a heterogeneous solution will have two or more phases. Heterogeneous solutions are further divided into :

(a) Colloids, (b) Suspension, and (c) Precipitate

(a) **Colloids :** In colloids, the particle size is between 10^{-7} and 10^{-4} cms.

(b) **Suspension :** In suspension, the particle size is between 10^{-4} cms and 10^{-3} cms.

(c) **Precipitate :** In a precipitate, the particle size is greater than 10^{-3} cm.

Apparatus : Beaker, glass rod, glucose, potassium chloride, sulphur powder, graduated cylinder, etc.

Procedure : Take about 200 ml of water in a beaker and add some glucose in it and stir it with the help of a glass rod. Glucose dissolves completely. Glucose is a covalent molecule. Therefore its molecular state will not change (See Figure 4.3.1). It is a true solution.

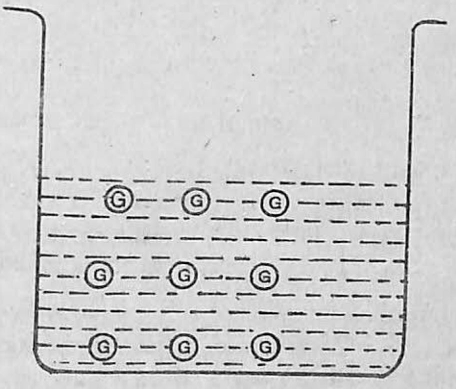


Fig. 4.3.1 Solution of Covalent Compound

(ii) Take about 200 ml of water and add some potassium chloride in it. Potassium chloride dissolves on shaking the solution. Potassium chloride is an ionic or electrovalent compound. When it is dissolved in water, it is splitted up into K^+ and Cl^- as shown in Fig 4.3.2. It is also a true solution.

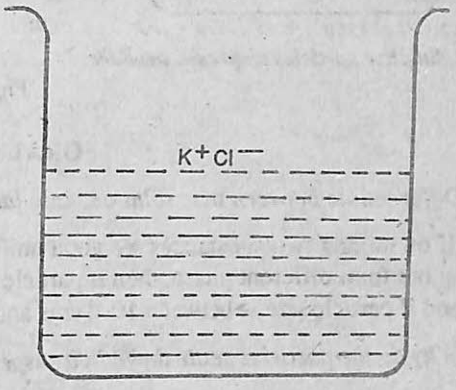
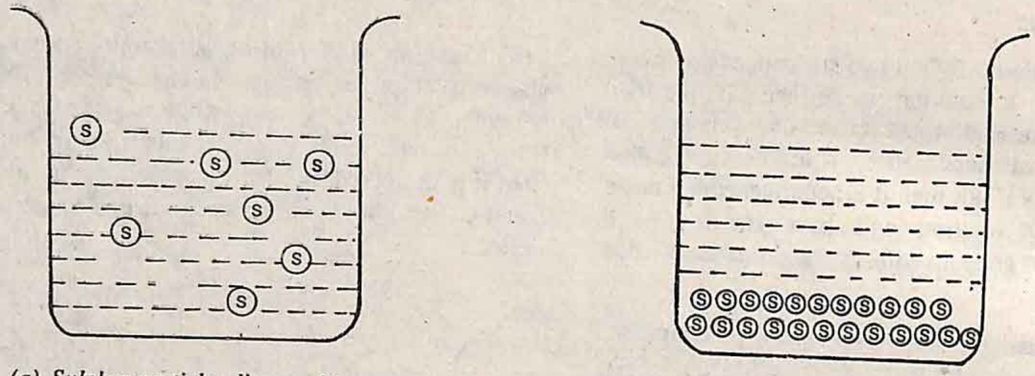


Fig. 4.3.2 Solution of Ionic Substance

(iii) Take about 200 ml of water and add some sulphur powder to it. Shake it vigorously either wih the help of a mechanical stirrer or a glass rod. Sulphur will not dissolve but it will be dispersed in water. It may form a suspension (Fig 4.3.3. (a)). On keeping, sulphur particles also settle down as shown in Fig. 4.3.3 (b).

Inference : In true solutions, the solute is completely mixed up and it does not settle down even on keeping for a long time but in suspensions, particles of solute settle down on keeping under influence of gravity.



(a) *Sulphur particles dispersed in water*

(b) *Sulphur paticles settle down after some time.*

Fig. 4.3.3

ORAL QUESTIONS

Q. 1. *Differentiate between true solution, colloidal solution and suspension.*

Ans. If on mixing two substances we get a uniform phase it is a true solution. If the two substances do not mix up but form different phase, then if particle size is between 10^{-7} cms and 10^{-4} cms it is a colloidal solution and if particle size is between 10^{-4} cms and 10^{-3} cms it is a suspension.

Q 2. *Why do the particles settle down in a suspension ?*

Ans. The particles settle down in a suspension due to the effect of gravity.

Q. 3. *Is there any role of settling down of particles by suspension while explaining the formation of deltas ?*

Ans. Yes, when the river approaches the sea, the speed of river is decreased considerably. Thus settling down of sand particles starts.

□□

EXPERIMENT 4.4

To distil salt solution to prepare pure water (salt free).

Introduction : There are different methods for purification of homogeneous and heterogeneous solutions. Salt solution is a homogeneous solution, thus the methods for purification of homogeneous solution will be used. Distillation is one method for this. In distillation, the mixture of salt and water is taken in a round-bottomed flask which is connected to a condenser as shown in Fig. 4.4. The round-bottomed flask is heated and water is converted into vapours which pass through the condenser where they are condensed and are collected on the other side as shown in the figure.

Apparatus and Chemicals : Round-bottomed flask, thermometer, wire gauze, tripod stand, burner, condenser, receiving flask, iron stand, common salt, etc.

Procedure : Take the round-bottomed flask and wash it with water thoroughly. Dry it in an electric oven. Now take the given solution of salt and water in the round-bottomed flask and place it on a tripod stand as shown in Fig. 4.4.1. A wire gauze should be placed on the tripod stand before placing the round-bottomed flask on the tripod stand. Now insert the cork and condenser in the round-bottomed flask as shown. Insert the receiving flask in the condenser. Place a bunsen burner below the tripod stand and start heating the round-bottomed flask. Vapours of water will be seen rising and then passing through condenser where they are cooled and are condensed. This condensed liquid is collected in the receiving flask. In this way pure water can be obtained.

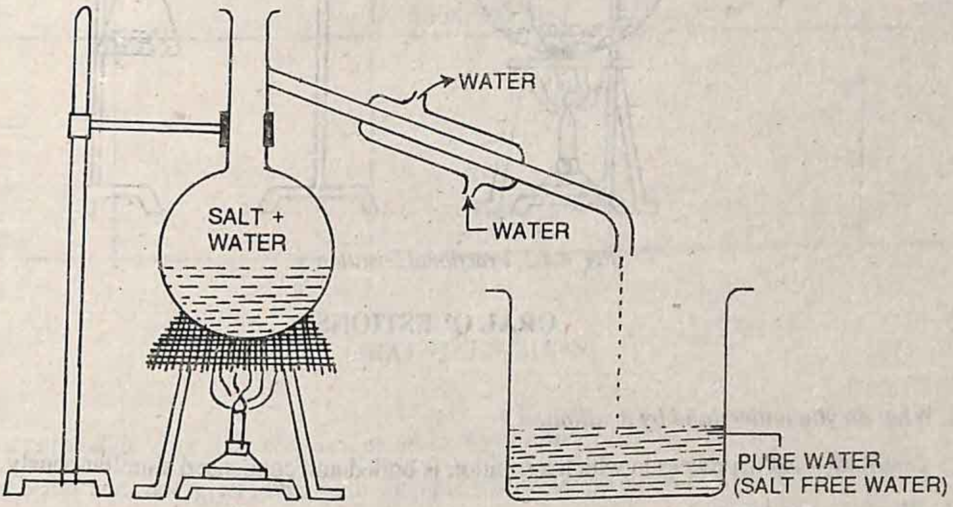


Fig. 4.4.1 Distillation

Observation : Vapours of water rise which pass through the condenser, where they are cooled. After cooling they are converted into liquid.

Conclusion : Salt is a non-volatile substance and water is volatile. So a more volatile substance is purified by distillation if it is present along with a less volatile or a non-volatile substance in solution.

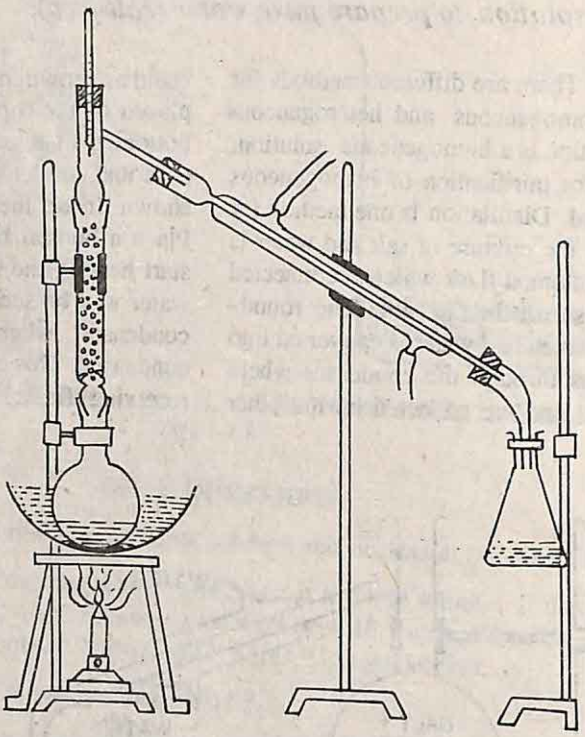


Fig. 4.4.2. Fractional Distillation

ORAL QUESTIONS

Q. 1. *What do you understand by distillation ?*

Ans. Distillation is the process in which a solution is boiled and condensed simultaneously.

Q. 2. *What is a condenser ?*

Ans. Condenser is a long glass tube bent at both ends and middle part is surrounded by a glass jacket.

Q. 3. *What is fractional distillation ?*

Ans. Fractional distillation is a process in which two miscible liquids with boiling point differing by 20°C are taken in distillation flask and the mixture is boiled. Liquid with lower boiling point form vapour first which can be condensed. When the first liquid has been distilled off, then the second liquid starts forming vapours and condenses in a second receiving flask.

□□

EXPERIMENT 4.5

To collect different samples of water from different sources and to test them with soap solution to identify them as hard and soft water.

Introduction : A sample of water which gives lather with soap is called soft water and a sample of water which does not give lather with soap is called hard water.

Apparatus and Chemicals : Beakers, soap solution, water samples taken from some nearby well, Sohna spring, Jamuna river and the common tap water of houses.

Procedure : Take four beakers of 250 ml capacity each. Wash and dry them. Take about 100 ml of water sample from each source in four different beakers and mark them 1 to 4. Add equal amounts of soap solution to each of them. Stir them with the help of glass rod and observe the affect.

Conclusion : Hard water does not give lather with soap and soft water gives lather with soap.

Observation :

Beaker Number	Source of water	Amount of soap solution added	Lather formed or not	Type of water
1				
2				
3				
4				

ORAL QUESTIONS

Q. 1. *What is the difference between hard water and soft water ?*

Ans. Hard water does not give lather with soap but soft water gives lather with soap.

Q. 2. *Why does hard water not give lather with soap ?*

Ans. Hard water contains calcium ions and magnesium ions which combine with $RCOO^-$ of soap and form a precipitate.

Q. 3. *How do you convert soft water into hard water ?*

Ans. Soft water can be converted into hard water by adding calcium and magnesium salts.

Q. 4. *How do you convert hard water into soft water ?*

Ans. There are two types of hardnesses of water–Temporary and permanent. Temporary hardness can be removed by boiling hard water and permanent hardness can be removed by zeolite process or by adding washing soda to the hard water.

Q. 5. *What happens when temporary hard water is boiled ?*

Ans. Calcium Bicarbonate is present in temporary hard water. On boiling calcium carbonate is precipitated.

□□

EXPERIMENT 4.6

To remove temporary hardness by boiling.

Apparatus and Chemicals : Beakers, hard water.

Procedure : Take a beaker and take about 100 ml of temporary hard water in the beaker. Place it on a tripod stand and boil it.

Observation : On boiling the sample of water calcium carbonate is precipitated.

Conclusion : Temporary hardness of water can be removed by boiling.

Note : For oral questions see Experiment 4.5.

EXPERIMENT 4.7

To show the presence of (i) water vapours, (ii) dust particles, (iii) carbon dioxide in atmosphere.

Introduction : Atmosphere contains various constituents *e.g.*, Oxygen gas 21 percent by volume, Nitrogen 78 per cent, Carbon dioxide approximately 0·04 per cent and dust particles, argon, water vapours etc.

Apparatus and Chemicals : Watch glasses, anhydrous Calcium chloride, lime water, milk, china dish etc.

Procedure : Take three watch glasses. Number these as 1, 2 and 3 and keep them in open. Place some anhydraws calcium chloride in the first water glass and pour small amount of lime water in the second glass. Pour some milk in third watch glass and keep them in open for about 3-4 hours.

Observation :

Watch glass number	Substance in watch glasses	Change after keeping in atmosphere	Inference
1	Anhydrous calcium chloride	Becomes moist, turns milky, dust particles are seen at the surface of milk.	
2	Lime water		
3	Milk		

Conclusion : Atmosphere contains moisture, carbon dioxide and dust particles.

ORAL QUESTIONS

Q. 1. *Name the main constituents of air.*

Ans. The main constituents of air are oxygen, nitrogen, carbon dioxide and some water vapours, dust particles and oxygen gas.

Q. 2. *Why does lime water turn milky on keeping in air ?*

Ans. Air contains carbon dioxide which combines with lime water forming calcium carbonate which is insoluble in water. This forms the milkiness.

Q. 3. *Why does anhydrous calcium chloride become moist on keeping in air ?*

Ans. Anhydrous calcium chloride is hygroscopic in nature *i.e.*, it absorbs water. Hence when it is kept in air it absorbs the moisture from air.

Q. 4. *Why do dust particles settle on surface of milk ?*

Ans. Dust particles are suspended in air. Under the influence of gravity, dust particles settle down.

EXPERIMENT 4.8

To identify the products of combustion of different kinds of fuels.

Introduction : Fuel is a substance which is burnt to obtain heat energy. There are three types of fuels—solid, liquid and gaseous. Example of solid fuel is wood, that of liquid is kerosene oil and that of gas is common household cooking gas L.P.G.

Apparatus and Chemicals : Wood splinter, coke, kerosene oil, L.P.G., burner, ethyl alcohol, match box, *etc.*

Procedure :

(i) Hold the wood splinter from one end and burn it at the other end (Figure4.8) and observe.

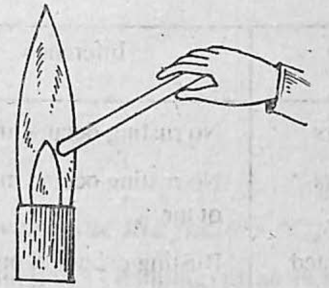


Fig. 4.8 Burning of wood splinter

(ii) Take a small piece of coke and try to burn it. Observe the changes and products obtained.

(iii) Take some kerosene oil in a china dish and burn it. Observe the changes.

(iv) Take some ethyl alcohol in a china dish and burn it. Observe the changes and products obtained.

(v) L.P.G. cylinder is connected to gas supply line in laboratory. The bunsen burner is connected to the gas. The gas tap is opened and the gas is made to burn. Observe the changes and products obtained.

Observations :

S. No.	Name of fuel	Observation
1.	Wood splinter	
2.	Coke	
3.	Kerosene oil	
4.	Ethyl alcohol	
5.	L.P.G.	

Conclusion : Type of products obtained after combustion depends upon type of fuel.

ORAL QUESTIONS

Q. 1. *What is fuel ?*

Ans. Fuel is a substance which is made to burn to obtain heat energy.

Q. 2. *What are various types of fuels ?*

Ans. Fuels are of three types : Solid fuels, liquid fuels and gaseous fuels.

Q. 3. *What is combustion ?*

Ans. Combustion is a process in which certain substance is burnt and as a result of this heat and light are produced.

Q. 4. *What is Calorific value ?*

Ans. The amount of heat produced by burning a unit mass of fuel completely is known as Calorific Value.

Q. 5. *What are the characteristics of a good fuel ?*

Ans. It should be cheap, easily storeable, should not give out poisonous or harmful gases on burning and should have a high Calorific Value.

Q. 6. *What are the contents of L.P.G. ?*

Ans. L.P.G. contains butane and isobutane.

□ □

EXPERIMENT 4.9

To show rusting of Iron in presence of air and water and identify the conditions for rusting of iron.

Introduction : Rusting is a process in which a metal surface is exposed to moist air. Surface of metal reacts with moist air and forms oxides. In case of iron surface the compound formed is brown with formula $Fe_2O_3xH_2O$ and this brown compound can be pealed off. It is a slow oxidation process.

Apparatus and Chemicals : Test tubes, iron nails, Calcium chloride, oil or vaseline, glass wool rubber corks, sand paper, burner, etc.

Procedure : Rub the iron nails with sand paper and place some of them in a test tube. Insert a pad of glass wool in this test tube and place some drops of calcium chloride over it. Cork the tube and mark this test tube as 'A' (Figure 4.9).

Take a second tube and place some clean iron nails inside the test tube. Add some distilled water in this test tube and heat to boiling. Cool and pour some oil so that a layer of oil is formed at the surface of water. Cork the test tube and mark it as 'B'.

Take a third test tube C and place some clean nails in the test tube. Pour some distilled water in it and cork it.

Keep all the test tubes in this position for about one week and observe the changes.

Observations :

Test tube No.	Contents and conditions of test tube	Observation	Inference
A.	Iron nails + glass wool with $CaCl_2$	No rusting occurs	No rusting occurs in dry air
B.	Nails +Boiled water + oil	No rusting occurs	No rusting occurs in absence of air
C.	Iron nails + water	Iron nails are rusted	Rusting occurs in presence of moist air.

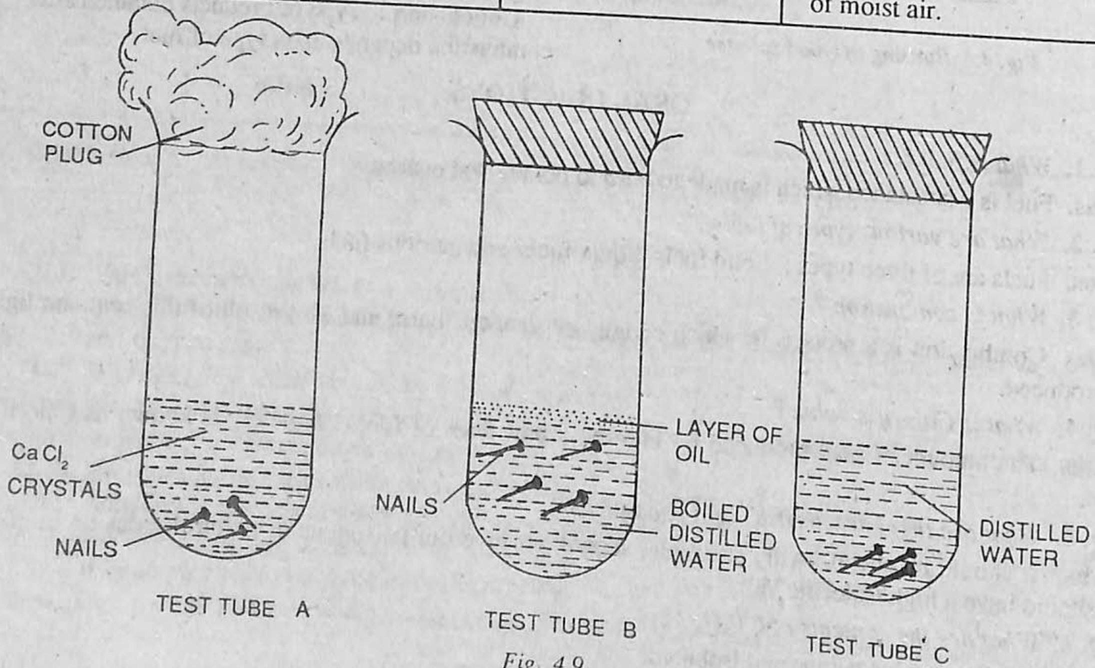


Fig. 4.9

ORAL QUESTIONS

Q. 1. *Explain the process of rusting.*

Ans. Rusting is the process in which the metal surface by getting in contact with the moist air reacts to form oxides.

Q. 2. *How can we prevent rusting ?*

Ans. Rusting can be prevented by painting, oiling and putting grease on metal surface or by galvanizing the metal.

Q. 3. *What is galvanization ?*

Ans. Galvanization is the process in which the metal surface is covered with a coating of zinc to prevent rusting.

Q. 4. *Are burning and rusting same type of processes ?*

Ans. Both are oxidation processes but burning is a rapid process and rusting is a slow process.

EXPERIMENT 4.10

To investigate the factors responsible for pollution of air.

Introduction : Pollution of air is now a major problem. Air is being polluted constantly. It is quite certain that human life is being subjected to the harmful effects of it (Fig. 4.10). Factories leave smoke in air. Motor vehicles also throw waste gases after combustion into the atmosphere. Carbon dioxide, nitrogen dioxide, sulphur dioxide and lead vapours, etc., have harmful effects on human beings. Hence it is very essential to see the causes of pollution and how it should be prevented.

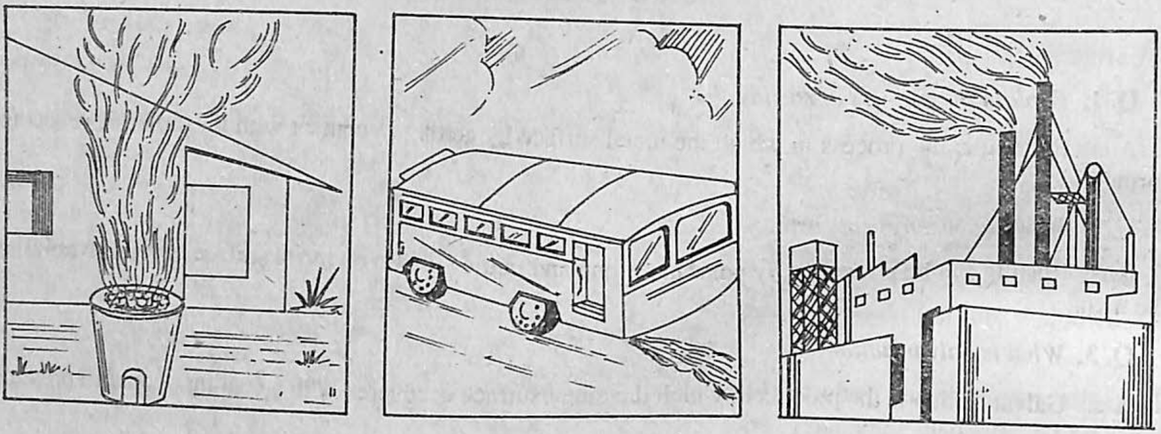
Apparatus and Materials : Charts exhibiting various types of pollution.

Procedure : Examine these charts carefully and try to find out the various gases being thrown into the atmosphere.

Observation:

S. No.	Name of agency throwing the various gases into atmosphere	Gases being thrown into the atmosphere
1.	Domestic fuel	CO and CO_2
2.	Motor vehicle fuel	CO, CO_2 and lead
3.	Engine exhausts	CO, CO_2, NO and NO_2
4.	Brickfield	SO_2, CO_2, CO
5.	......	......

Conclusion : Air pollution is caused by various sources like motor vehicles, factories, engines, etc.



4.10 (a) *Sources of Air Pollution*

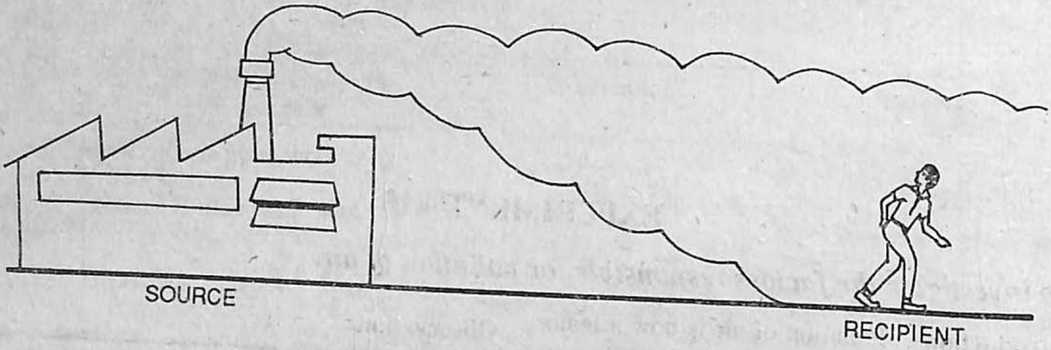


Fig. 4.10 (b) Movement of air pollutant from source to recipient

ORAL QUESTIONS

Q. 1. *What is air pollution ?*

Ans. If atmospheric air is spoiled by the addition of poisonous gases like carbon monoxide, etc., air is said to be polluted and this process is called air pollution.

Q. 2. *Name some of the factors which cause air pollution.*

Ans. Various factors which cause air pollution are—smoke from vehicles and chimneys etc.

Q. 3. *What are the factors which pollute water ?*

Ans. Poisonous liquids from factories pollute river water which is quite dangerous to aquatic life.

Q. 4. *What are the factors which cause land pollution ?*

Ans. Land is polluted by throwing waste products and daily refuse.

Q. 5. *Can air pollution be prevented ?*

Ans. Yes, it can be avoided by inserting electrical precipitators in the chimneys of factories.

EXPERIMENT 4.11

To observe changes when sulphur is heated till it boils.

Introduction : Sulphur occurs in nature in free and combined both state. Sulphur is extracted by Frasch Process. Sulphur exists in various allotropic forms *i.e.* α-sulphur, β-sulphur, colloidal sulphur and plastic sulphur.

Procedure : Take a test tube and take some powdered sulphur in this test tube. Heat till it melts. Take a funnel and insert a good quality of filter paper in this funnel in the form of a cone. Pour the molten sulphur in this filter paper cone. As the solidification of sulphur starts, pour out the liquid sulphur in a petri dish. On cooling, fine crystals are obtained. This is prismatic sulphur.

Once again take some powdered sulphur in a china dish and go on heating till it boils.

Observe the changes.

Observation:

Temperature	Observation
368·5 K	Rhombic sulphur changes to Monoclinic sulphur.
392 K	Light yellow liquid called α-Sulphur.
Above 392 K	Light yellow changes to brown and Viscosity increases.
473 K	Brown liquid becomes viscous
473 K to 523 K	Viscosity decreases
717 K	Mobile liquid boiling occurs. Red vapours are obtained.

Conclusion : Sulphur exists in various forms at different temperatures.

ORAL QUESTIONS

Q. 1. *What is allotropy ?*

Ans. Allotropy is a phenomenon in which an element exists in various atomic arrangements.

Q. 2. *On heating viscosity of a substance decreases and then increases. Why ?*

Ans. Sulphur has a puckered ring structure. When it is heated the ring is broken and then the chains intermingle with each other. Due to intermingling of chains the viscosity increases.

EXPERIMENT 4.12

To prepare compost from waste.

Introduction : If the refuse of our daily life is thrown on land or in water, it will cause land pollution or water pollution. So this refuse should be properly used.

This refuse can be converted into a kind of fertilizer with the help of decomposition of plant and animal matter. This fertilizer is termed as compost which may be prepared by making a heap consisting of layers of soil, manure, weeds, garbage, leaves, etc. one over the other. Best condition to obtain compost is that the total heap should remain moist. Under these conditions plant matter is easily digested.

Apparatus : Wooden stall, metre tape.

Chemicals : Lime, Superphosphate, Potassium hydroxide, etc.

Procedure : A wooden case of length 2 metres, width 2 metres and height 1·5 metres is made. Instead of wooden case, a pit of the same dimension may be made in soil. Now a layer of about 30 cm height consisting of grass, leave and other refuse is made in the pit. On this layer of refuse, lime along with top soil and plant food are placed so that the height of second layer may be in-between 8-10 cms. Once again on the second layer, a third layer of grass, leaves and other refuse is placed. The height of this layer is again 30 cms. In this way layer over layer are repeated till the required height is attained. Water is sprayed over it from time to time so that it may remain moist. It may also be forked from time to time. After a period 5-6 months compost will be prepared.

Conclusion : Microbes convert waste plant and waste animal products into a useful compound called compost.

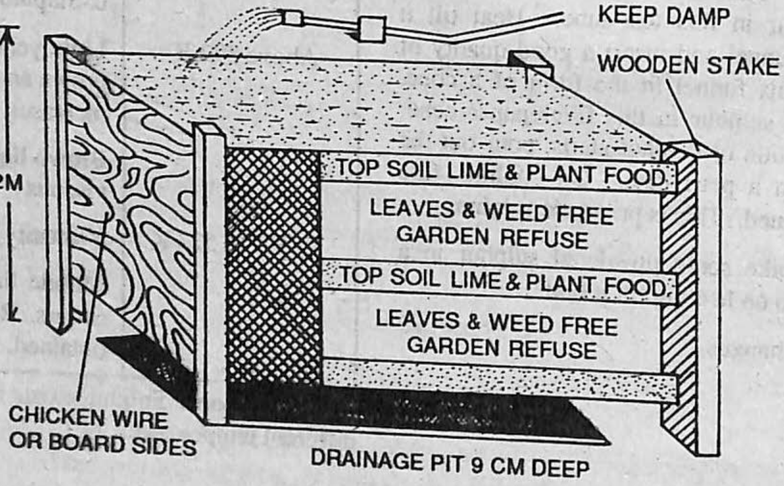

KEEP DAMP
WOODEN STAKE
2M
TOP SOIL LIME & PLANT FOOD
LEAVES & WEED FREE GARDEN REFUSE
TOP SOIL LIME & PLANT FOOD
LEAVES & WEED FREE GARDEN REFUSE
CHICKEN WIRE OR BOARD SIDES
DRAINAGE PIT 9 CM DEEP

Fig. 4.12. Preparation of compost .

ORAL QUESTIONS

Q. 1. *What is compost ?*

Ans. Compost is a useful product obtained from waste plants and waste animal products. It is prepared with the help of microbes.

Q. 2. *What is the use of preparing compost ?*

Ans. Preparation of compost controls the land and water pollution.